

Dubrovnik, Yugoslavia, is an ancient seaport and resort on the Adriatic. Founded by Romans in the 7th century and fortified in the Middle Ages, it became a center of Serbo-Croatian culture.

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FUNK & WAGNALLS NEW ENCYCLO- PEDIA

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WATFORD

to ZYMOLOGY

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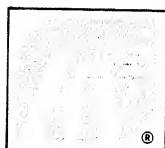
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**FUNK &
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LIST OF ABBREVIATIONS USED IN THE TEXT*

abbr.	abbreviated	ft.	from	OHG.	Old High German
AC or a-c	alternating current	Fr.	French	ON.	Old Norse
A.D.	<i>anno Domini</i> (Lat., in the year of the Lord)	ft.	foot	ONF.	Old Norman French
		g	gram	O.T.	Old Testament
alt.	altitude	Gael.	Gaelic	oz.	ounce
A.M.	<i>ante meridiem</i> (Lat., before noon)	gal.	gallon	P.M.	<i>post meridiem</i> (Lat., after noon)
A.M.	amplitude modulation	Ger.	German	Poi.	Polish
amu or	atomic mass unit	Gr.	Greek	pop.	population
ant.	ancient	Heb.	Hebrew	Port.	Portuguese
Ar.	Arabic	Hind.	Hindustani	prelim.	preliminary
AS.	Anglo-Saxon	hp.	horsepower	pron.	pronounced
A.S.S.R.	Autonomous Soviet Socialist Republic	hr.	hour	q.v.	<i>quod vide</i> (Lat., which see)**
at.no.	atomic number	Hung.	Hungarian	r.	reigned
at.wt.	atomic weight	Hz	hertz or cycles per second	R.	River
b.	born	i.	Island	rev.	revised; revision
bbi	barrel	id est	<i>id est</i> (Lat., that is)	R.R.	railroad
B.C.	before Christ	in.	inch	Rum.	Rumanian
bd.ft.	board feet	Ind.	Indian	Russ.	Russian
bev or	billion electron volts	Ir.	Irish	Ry.	railway
b.p.	boiling point	It.	Italian	S.	south; southern
B.T.U.	British Thermal Unit	K.	Kelvin	sec.	second
bu.	bushel	kg	kilogram	S.F.S.R.	Soviet Federated Socialist Republic
Bulg.	Bulgarian	kMz	kilohertz	Skr.	Sanskrit
C.	centigrade	km	kilometer	Sp.	Spanish
cent.	century	kw	kilowatt	sp.gr.	specific gravity
Chin.	Chinese	kw hour	kilowatt hour	sq.	square
cm	centimeter	lat.	latitude	sq.mi.	square mile
Co.	County	Lat.	Latin	S.S.R.	Soviet Socialist Republic
colloq.	colloquial	lb.	pound	St.; Ste.	Saint
cu.	cubic	long.	longitude	Sum.	Sumerian
Czech.	Czechoslovakian	m	meter	Sw.	Swedish
d.	died	M.	Middle	temp.	temperature
Dan.	Danish	mev or	million electron volts	trans.	translation
DC; d-c	direct current	MEV	megahertz	Turk.	Turkish
Du.	Dutch	MHz	mile	U.K.	United Kingdom
E.	east; eastern	mi.	minute	U.N.	United Nations
ed.	edition; editor	min.	millimeter	U.S.	United States
Egypt.	Egyptian	mod.	modern	U.S.A.	United States of America
Eng.	English	m.p.	melting point	U.S.S.R.	Union of Soviet Socialist Republics
est.	estimated	m.p.h.	miles per hour	var.	variant
ev or	electron volt	Mt(s).	Mount, Mountain	vol.	volume
EV	Fahrenheit	N.	north; northern	vs.	versus or against
F.	flourished	Norw.	Norwegian	W.	west; western
FM	frequency modulation	N.T.	New Testament	yd.	yard
		OE.	Old English		
		OF.	Old French		

*For a more extensive listing of abbreviations, widely used by authoritative sources in many fields, see ABBREVIATION. Charts of pertinent abbreviations also accompany the articles BIBLE, CANON OF THE; DEGREE, ACADEMIC; ELEMENTS, CHEMICAL; MATHEMATICAL SYMBOLS; and WEIGHTS AND MEASURES. Accent marks and special letters are explained in the article DIACRITIC MARK.

**The abbreviation (q.v.) stands for the Latin words "quod vide", meaning "which see". The placement of this abbreviation after a word—or a name or term—indicates that the word itself is the title of a separate article in the encyclopedia. By looking up the article on this word, or the entries on each word in a series that is followed by the plural form (qq.v.) of the abbreviation, the reader will find specific information about the words used as well as data about the main topic of the article he is reading.

FUNK & WAGNALLS NEW ENCYCLOPEDIA

WATFORD, Great Britain, municipal borough of Hertfordshire, England, on the Colne and Gade rivers, 16 miles N.W. of London. Connected with London by road and rail, the borough includes among its industries printing and publishing, food processing, brewing, and the manufacture of chemicals, leather, and paint. It is the site of a technical college and also of Cassiobury Public Park, in which was the residence of the earls of Essex (q.v.). The Oxhey residential area in the s. includes Oxhey Woods and Public Park. Watford has a rebuilt 15th-century church, and in 1813 the London Orphan School was founded here. The borough was formed in 1922. Pop. (1971) 78,465.

WATKINS GLEN, village in New York, and county seat of Schuyler Co., at the s. end of Seneca Lake, about 20 miles N. of Elmira. The village is a salt-producing center and a resort noted for its scenic beauty and mineral springs; it is also a shipping point for the surrounding grape-growing area. Adjoining the village is the famous Watkins Glen State Park, covering 540 acres and containing Watkins Glen, a narrow canyon, 2 mi. in length and rising as high as 300 ft., through which a stream falls 1200 ft. in a series of cascades, rapids, and pools. The site of the village was settled in 1788 and the settlement was known as Salubria until 1842, when it was incorporated as Jefferson. It was named Watkins Glen in 1852 in honor of Dr. Samuel Watkins, an early resident, who had laid out and mapped the village. Pop. (1960) 2813; (1970) 2716.

WATLING ISLAND. See SAN SALVADOR.

WATSON, James Dewey (1928–), American biochemist, born in Chicago, Ill. He received a Ph.D. degree from the University of Indiana in 1950 and joined the faculty of Harvard University in 1955. From 1951 to 1953 he did postgraduate research with the British biophysicist Francis Harry Compton Crick (q.v.) at the Cavendish Laboratory, Cambridge University. Based on

work done by the British biophysicist Maurice Hugh Frederick Wilkins (q.v.), Watson and Crick evolved a theoretical helical structure for the deoxyribonucleic acid (DNA) molecule, a substance that transmits genetic characteristics from one generation to the next; see NUCLEIC ACIDS. Experimental proof for their theory was later provided by the American biochemist Arthur Kornberg (1918–). For their work on the DNA molecule, Watson, Crick, and Wilkins shared the 1962 Nobel Prize in medicine and physiology. In 1968 Watson became director of the Cold Spring Harbor Laboratory of Quantitative Biology, in New York State. Watson wrote *The Double Helix* (1968), the story of the discovery of the structure of DNA.

WATSON, John Broadus (1878–1958), American psychologist, born in Greenville, S.C., and educated at Furman University and the University of Chicago. From 1908 to 1920 he was professor of psychology and director of the psychological laboratory at Johns Hopkins University. He subsequently became an executive in an advertising agency. Watson is noted as the founder and leading exponent of the school of psychology known as behaviorism (q.v.), which restricts psychology to the study of objectively observable behavior and explains behavior in terms of stimulus and response. His writings include *Animal Education* (1903), *Behavior* (1914), *Behaviorism* (1925; rev. ed., 1930), and *Psychological Care of Infant and Child* (1928).

WATSON, Thomas John (1874–1956), American industrialist, born in Campbell, N.Y., and educated at the Elmira School of Commerce. He was employed by the National Cash Register Company before joining the Computing-Tabulating-Recording Company in 1914 as its president. In 1924 the name of his firm was changed to the International Business Machines Corporation (q.v.), commonly known as IBM, and after 1949 Watson was chairman of the board. Ex-

WATSONVILLE

panding the corporation into foreign markets, Watson turned IBM into a multimillion-dollar business. At the time of his death it employed more than 60,000 persons in 200 offices throughout the world, held 1500 patents, and manufactured about 6000 different models of business machinery. Corporate research and development was responsible for producing the automatic digital computer, first used in 1944; see **COMPUTER**.

Watson's older son, Thomas John Watson, Jr. (1914–), became president (1952) and later chairman of the board (1961) of IBM. By 1970, 80 percent of IBM's business was related to the electronic computer and the company had more than 250,000 employees in about 100 countries.

WATSONVILLE, city of California, in Santa Cruz Co., about 16 miles s.e. of Santa Cruz. It is a processing and distribution center for vegetables and fruits. Nearby are many beach and mountain resorts and State parks. Watsonville was founded in 1851 and incorporated in 1868. Pop. (1960) 13,293; (1970) 14,569.

WATSON-WATT, Sir Robert Alexander (1892–1973), British physicist, born in Brechin, Scotland, and educated at the University of St. Andrews. From 1915 to 1952 he held various posts in the British government's scientific and technical departments, specializing in research into electromagnetic radiations, meteorology, radio, and their applications to aviation (qq.v.).

Watson-Watt is most famous, however, for his contribution to the development of radar (q.v.). After obtaining the first patent on a long-distance radar instrument used in atmospheric study in 1919, he continued his research into the potential uses of high-frequency radio waves, now called microwaves, for locating objects beyond the range of vision. In 1935 he successfully demonstrated a new type of radio-locating device that could spot and count aircraft, by night and by day, at distances exceeding 100 mi. This led to the development at a critical time of the first practical system of radar that was used effectively against German aircraft in World War II. Radar is now used universally in navigation, traffic control (qq.v.), meteorology, and intercontinental defense; see **COAST DEFENSE: Intercontinental Air Defense**.

Watson-Watt was knighted in 1942, and received many other honors, including the United States Medal of Merit in 1946. His books include *Through the Weather House* (1935); an autobiography, *The Pulse of Radar* (1959); and *Man's Means to His End* (1961).

WATT. See **ELECTRICAL UNITS**.

WATT, James (1736–1819), British inventor and mechanical engineer, born in Greenock, Scotland. He worked as a mathematical-instrument maker from the age of nineteen, and soon became interested in improving the steam engine, invented by the English engineers Thomas Savery (1650–1715) and Thomas Newcomen (1663–



James Watt

1729), which was used at the time to pump water from mines; see **STEAM AND STEAM ENGINEERING**.

Watt determined the properties of steam, especially the relation of its density to its temperature (qq.v.) and pressure, and designed a separate condensing chamber for the steam engine that prevented enormous losses of steam in the cylinder and enhanced the vacuum conditions; see **HEAT; VACUUM; VACUUM PUMPS**. Watt took out his first patent in 1769, which covered this device and other improvements on Newcomen's engine, such as steam-jacketing, oil lubrication, and insulation of the cylinder to maintain the high temperatures necessary for maximum efficiency.

At this time, he was the partner of the British inventor John Roebuck (1718–94), who had financed his researches. In 1775, however, Roebuck's interest was taken over by British manufacturer Matthew Boulton (1728–1809), owner of the Soho Engineering Works at Birmingham, and he and Watt began the manufacture of steam engines. Watt continued his research and patented several other important inventions, in-

cluding the rotary engine for driving various types of machinery; the double-action engine, in which steam is admitted alternately into both ends of the cylinder; and the steam indicator, which records the steam pressure in the engine. He retired from the firm in 1800 and thereafter devoted himself entirely to research work.

The misconception that Watt was the actual inventor of the steam engine arose from the fundamental nature of his contributions to its development. The centrifugal or flyball governor, which he invented in 1788, and which automatically regulated the speed of an engine, is of particular interest today. It embodies the feedback principle of a servomechanism (q.v.), linking output to input, which is the basic concept of automation (q.v.), and the electrical unit, the watt, was named in his honor; see ELECTRICAL UNITS: *Practical Units*. Watt was also a renowned civil engineer, making several surveys of canal routes. He invented, in 1767, an attachment that adapted telescopes for use in measurement of distances. Among other inventions credited to him are a device for reproducing sculpture and a letter-copying press.

WATTEAU, Jean Antoine (1684–1721), French painter, born in Valenciennes, a Flemish town which had become French shortly before his birth. At the age of fourteen he began to study painting under an obscure painter of religious subjects in his native town. In 1702 he went to Paris, where he eked out a living as a painter for a dealer in cheap devotional pictures. He later studied under the French engraver and stage designer Claude Gillot (1673–1722) and about 1708 began to work with the decorative artist Claude Audran, curator of the Luxembourg Palace collections. There he had an opportunity to study a great series of paintings by the Flemish master Peter Paul Rubens (q.v.). In 1709 he placed second in the competition for the Prix de Rome and thereafter received many important commissions. Named an associate of the French Academy in Paris in 1712, he was elected to full membership in 1717. Watteau, who had a frail constitution and was often ill, succumbed to tuberculosis in 1721.

Criticism. Watteau's canvases reflect the influ-

"The Italian Comedians" by Jean Antoine Watteau.

National Gallery of Art



WATTMETER

ence of the great Flemish painters, particularly Rubens, and of the Venetian School of Painting (q.v.); however, a feeling for light and color and a delicate sensuousness and lyric grace peculiarly his own distinguish his style. His reputation declined with the rise of neoclassicism (see CLASSICISM) in French art, but after the French Revolution and especially in the Romantic period (see ROMANTICISM) it rose again.

Watteau is now regarded as one of the outstanding artists of the rococo (q.v.) period and as a forerunner of 19th-century impressionism (q.v.). Among his favorite subjects are fashionable outdoor gatherings, known as *fêtes galantes* (Fr., "scenes of gallantry"), and scenes from the theater. His best-known paintings include "The Embarkment for Cythera" (1717, Louvre, Paris), "The Italian Comedians" (between 1716–20, National Gallery, Washington, D.C.), and "L'Enseigne de Gersaint" (1720, Staatliche Museum, Berlin). The "L'Enseigne de Gersaint", a signboard painted for the shop of an art dealer and friend of Watteau, is a masterpiece of genre realism which had great influence on the styles of the later 18th and early 19th centuries.

WATTMETER. See ELECTRIC METERS: *Miscellaneous Measurements*.

WATTS, George Frederic (1817–1904), British painter and sculptor, born in London, England, and largely self-taught. His earliest works were portraits, but his scope soon broadened to include historical and allegorical subjects. In 1843 he went to Italy, where he spent most of the following three years painting and studying the old Italian masters, particularly Tintoretto and Titian (qq.v.). He was elected a member of the Royal Academy in 1867 and received many prizes and honors throughout his lifetime.

Watts painted about 300 portraits, including those of the Italian patriot Giuseppe Garibaldi and the British poets Alfred Tennyson (qq.v.) and Robert Browning (see *under* BROWNING). His allegorical paintings include "Life's Illusions" (1849), "Love and Death" (1877), "Watchman, What of the Night" (1880), "Hope" (1886), and "Sic Transit" (1892). Among Watts' best-known sculptures are a memorial to Tennyson in Lincoln, England, and a huge equestrian statue that is part of a monument to the South African statesman Cecil John Rhodes (q.v.) in Kensington Gardens, London.

The professed purpose of Watts's art is to ennoble mankind. Most of his works are homilies in paint and stone on the pitfalls of wealth, the power of love, the folly of fearing death, and the like. His skill, however, was not quite equal

to his purpose. His style, although reflecting careful study of classic Greek sculpture and Italian painting, suffers from lack of discipline. His color is good and some of his portraits are penetrating, but his drawing and composition are generally weak and his symbolism vague and superficial.

WATTS, Isaac (1674–1748), English theologian and writer of texts for hymns, born in Southampton. He was educated at an academy for Dissenters (q.v.) at Stoke Newington (now part of London). After some years as a tutor, preacher, and assistant pastor, he became minister of a Dissenting church in London in 1702. By 1713 illness had forced him to give up some of his duties, but he remained copastor of the church. Watts' books on theological subjects were well known; for example, his *Scripture History* (1732) was a standard work well into the 19th century. Better known, however, were his *Horae Lyricae* (1706), a collection of religious poems, and his hymn texts; see HYMN: *Protestant Hymns*. He published two hymn collections, *Hymns* (1707; 2nd ed., 1709), and *The Psalms of David* (1719). Among individual hymns still in use are "When I Survey the Wondrous Cross" and "O God, Our Help in Ages Past". As a theologian, Watts showed a leaning toward Arianism, a tendency shared with many Dissenters of the time; see ARIUS; NONCONFORMISTS.

WAUGH, Evelyn Arthur St. John (1903–66), British author, born in London, England, and educated at the University of Oxford. In the decade between 1928 and 1938 he published five novels notable for their wit and pure satire on such aspects of upper-class British life as colonialism, public schools, and the manners and morals of high society. These novels are *Decline and Fall* (1928), *Vile Bodies* (1930), *Black Mischief* (1932), *A Handful of Dust* (1934), and *Scoop* (1938). *Put Out More Flags* (1942) is a novel about the British war effort during World War II.

Waugh's later writing was affected by his conversion to Roman Catholicism in 1930. *Brideshead Revisited* (1945), a serious novel probing the souls and fortunes of a declining aristocratic family of Roman Catholics, is considered by many critics to be Waugh's finest work. After a series of adventures befall the Marchmains, an English family who own a country estate called Brideshead, all the members of the family turn or return to the Church. In *The Loved One* (1948), Waugh returned to scathing satire, as he described American funeral practices for humans and pets in Hollywood, Calif.

Waugh's experiences during World War II as a commando in the Mediterranean theater of war led to a satirical trilogy, *Men at Arms* (1952), *Officers and Gentlemen* (1955), and *Unconditional Surrender* (1962). He also wrote travel books, biographies, and the autobiographical *A Little Learning* (1964). His older brother, Alexander Raban Waugh (1898–), known as Alec Waugh, is a writer of novels, including *Island in the Sun* (1956); travel books; and short stories. The travel books are especially noteworthy because of his reporting skills.

WAUKEGAN, city in Illinois, and county seat of Lake Co., on Lake Michigan, 35 miles N.W. of Chicago. It is a manufacturing, residential, and port city. Outboard motors, asbestos roofing, glass, wire, steel, chemicals and pharmaceuticals, and leather goods are the chief manufactures. An Indian village, and later a French outpost, occupied the site before the first permanent settlement, called Little Fort, was begun in 1835. Little Fort was incorporated as a village and renamed Waukegan in 1849 and chartered as a city in 1859. Pop. (1970) 65,269.

WAUKESHA, city in Wisconsin, and county seat of Waukesha Co., on the Fox R., 16 miles W. of Milwaukee. It is the center of a rich farming, dairying, and quarrying area and is a noted health resort. Pure-bred Holstein and Guernsey cattle and bottled waters from the plentiful nearby mineral springs are shipped from the city. Its principal industries include bottling and brewing and the manufacture of gasoline motors, dairy products, iron, steel, and aluminum castings, furniture, and agricultural machinery. Carroll College, founded in 1841, is in the city. Settled about 1834, the community was known as Prairieville until 1852, when it was incorporated as the village of Waukesha ("Little Fox"). It was chartered as a city in 1896. Pop. (1960) 30,004; (1970) 40,258.

WAUSAU, city in Wisconsin, and county seat of Marathon Co., on the Wisconsin R., 84 miles N.W. of the city of Green Bay. It is a business and shipping center for an agricultural section and has abundant water power. Industries include the manufacture of paper, metal, and stone goods, and the processing of agricultural products. A division of the University of Wisconsin is located in Wausau. Founded in 1839 as Gros Taureau, the community soon became an important lumber center. The present name was adopted in 1850. Wausau was incorporated as a village in 1861 and chartered as a city in 1872. Pop. (1960) 31,943; (1970) 32,806.

WAUWATOSA, city of Wisconsin, in Milwaukee Co., adjoining the city of Milwaukee on

the W. Wauwatosa is a residential suburb of Milwaukee, with some industries, notably the manufacture of chemicals, metal products, concrete products, metal castings, and lumber products. The city was settled in 1835 and incorporated in 1897. Pop. (1960) 56,923; (1970) 58,676.

WAVELL, Archibald Percival, 1st Earl Wavell (1883–1950), British army officer, born in Colchester, England, and educated at the Royal Military College, Sandhurst. He served in the South African War (q.v.) and in various frontier campaigns in India. During World War I (q.v.) he fought in Flanders, where he lost the sight of an eye, and served in the Egyptian Expeditionary Force under the British general Edmund Henry Allenby (q.v.), later 1st Viscount Allenby. Wavell became a major general in 1933; he was then the youngest officer of that rank in the British army. In 1939, at the outbreak of World War II, he was British commander in chief in the Middle East. In 1940–41 his forces won a brilliant victory over the Italian armies in Libya, accomplishing the first important Allied military success of the war; see *WORLD WAR II: The War in Africa*. Later in 1941, after serving in Greece and Crete, Wavell was appointed commander in chief in India. He served as supreme commander of Allied forces in Burma, Malaya, and the Netherlands East Indies for a period during 1942, and in December, 1942, he was promoted to the rank of field marshal. He was raised to the peerage in 1943. From 1943 to 1947 he was viceroy and governor-general of India. During his term he helped to advance the cause of Indian self-government; see *INDIA: History: Independence*. His writings include *The Palestine Campaigns* (1928), *Allenby* (1940–43), *Generals and Generalship* (1941), and *The Good Soldier* (1948).

WAVE MECHANICS. See QUANTUM MECHANICS; WAVE MOTION.

WAVE MOTION, in physics, mechanism by which energy (q.v.) is conveyed from one place to another in mechanically propagated waves without the transference of matter. At any point along the path of transmission there is a periodic displacement about a neutral position, known as a vibration (q.v.). The vibration may be of air molecules, as in the case of sound (q.v.) traveling through the atmosphere; of water molecules, as in waves occurring on the surface of the ocean; or of portions of a rope or a wire spring. In each of these cases the particles of matter oscillate about their own equilibrium position and only the energy moves continuously in one direction. Such waves are called mechanical because the energy is trans-

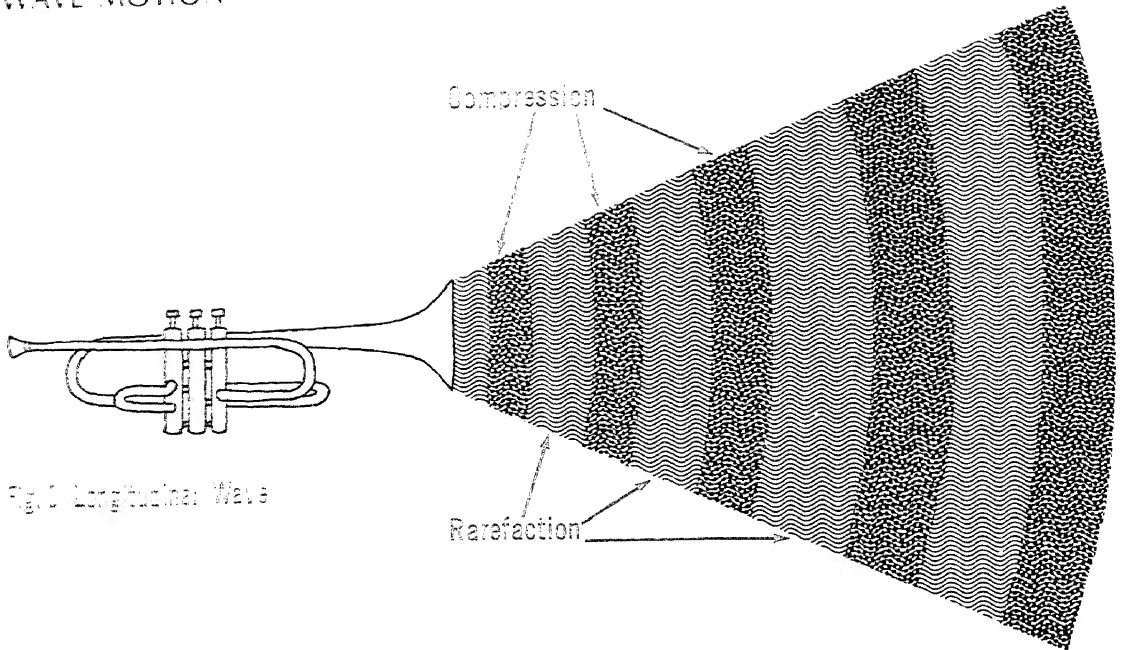


Fig. 1 Longitudinal Wave

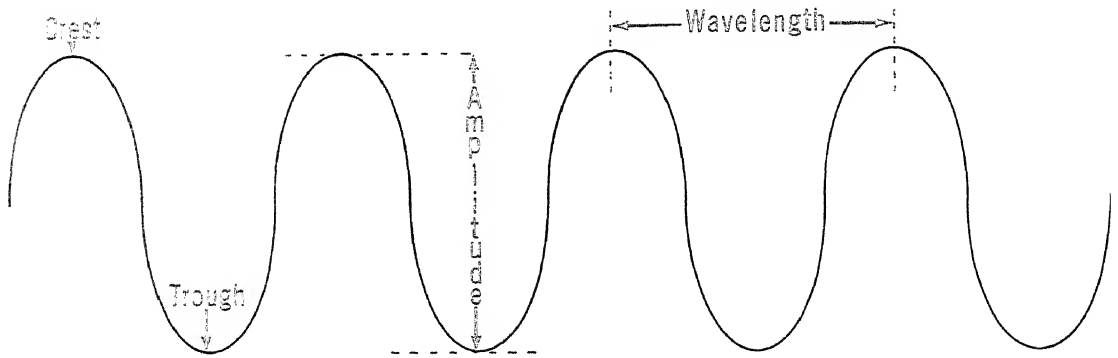


Fig. 2 Transverse Wave

Diagrams of wave motion.

mitted through a material medium, without a mass movement of the medium itself. The only form of wave motion that requires no material medium for transmission is the electromagnetic wave; in this case the displacement is of electric and magnetic fields of force in space; see ELECTRICITY; ELECTROMAGNETIC RADIATIONS; ELECTRONICS; FIELD.

Types of Waves. Waves are divided into types according to the direction of the displacements in relation to the direction of the motion of the wave itself. If the vibration is parallel to the direction of motion, the wave is known as a *longitudinal wave*; see Fig. 1. The longitudinal wave is always mechanical because it results from successive compressions (state of maximum density and pressure) and rarefactions (state of

minimum density and pressure) of the medium. Sound waves typify this form of wave motion. Another type of wave is the *transverse wave*, in which the vibrations are at right angles to the direction of motion. Such a wave may be mechanical, like the wave projected in a taut string that is subjected to a transverse vibration (see Fig. 2); or it may be electromagnetic, such as light, X ray (qq.v.), or radio waves (see RADIO). Some mechanical wave motions, such as waves on the surface of a liquid, are combinations of both longitudinal and transverse motions, resulting in the circular motion of liquid particles.

For a transverse wave, the wavelength is the distance between two successive crests or troughs. For longitudinal waves, it is the distance from compression to compression or rarefaction to rarefaction. The frequency of the wave is the number of vibrations per second;

see FREQUENCY. The velocity of the wave, which is the speed at which it advances, is equal to the wavelength times the frequency. The maximum displacement involved in the vibration is called the amplitude of the wave.

Behavior. The velocity of a wave motion in matter depends on the elasticity and density (qq.v.) of the medium. In a transverse wave on a taut string, for example, the velocity depends on the tension of the string and its mass per unit length. The velocity can be doubled by quadrupling the tension, or it can be reduced to one half by quadrupling the mass of the string. The motion of electromagnetic waves through space is constant at 186,000 mi. per sec., or the speed of light. This velocity varies slightly in passage through matter.

When two waves meet at a point, the resulting displacement of that point will be the sum of the displacements produced by each wave. If the displacements are in the same direction, the two waves reinforce each other; if the displacements are in the opposite direction, the waves counteract each other. This phenomenon is known as interference (q.v.); see also DIFFRACTION.

When two waves of equal wavelength and amplitude travel in opposite directions at the same velocity through a medium, stationary or standing waves are formed. For example, if one end of a rope is tied to a wall and the other end is shaken up and down, waves will be reflected back along the rope from the wall. Assuming that the reflection is perfectly efficient, the reflected wave will be half a wavelength behind the initiating wave. Interference will take place, and the resultant displacement at any given point and time will be the sum of the individual displacements. At points where the crest of the incident wave meets the trough of the reflected one, there will be no motion at all. Such points are called nodes. Halfway between the nodes, the waves meet in the same phase; that is, crest will coincide with crest and trough with trough. At these points the amplitude of the resultant wave is twice as great as that of the incident wave. Thus, the rope is divided into sections one wavelength long by the nodes, which do not progress along the rope, while the rope between the nodes vibrates transversely.

Standing or stationary waves are present in the vibrating strings of musical instruments. A violin string, for instance, when bowed or plucked, vibrates as a whole, with nodes at the ends, and also vibrates in halves, with a node at the center, and in thirds with two equally spaced nodes, and in various other fractions, all

simultaneously. The vibration as a whole produces the fundamental tone and the other vibrations produce the various harmonics (q.v.).

In quantum mechanics (q.v.), the structure of the atom is explained by analogy to a system of standing waves. Much of the development of modern physics is based on the elaboration of the theory of waves and wave motion.

See also EARTHQUAKE; OPTICS; QUANTUM THEORY. E.C.W.

WAVERLY NOVELS. See ENGLISH LITERATURE: *The Romantic Age; The Romantic Poets*; NOVEL: *Development of Genres: Historical Novel*; ROMANTICISM: *Literature: English Literature*; SCOTT, SIR WALTER.

WAVES. See WOMEN IN THE ARMED FORCES: *Naval Service*.

WAVES, ELECTROMAGNETIC. See ELECTROMAGNETIC RADIATIONS.

WAX, name applied originally to naturally occurring esters of fatty acids (qq.v.) and monohydric alcohols, but now applied to both natural and manufactured products resembling these esters. All such materials have a dull luster and a somewhat soapy or greasy texture. They soften gradually on heating, going through a soft, malleable state before ultimately forming a liquid. Fats and fixed oils (q.v.) resemble waxy esters, but differ in being formed from glycerin (q.v.), a trihydric alcohol. See ALCOHOL.

Typical animal waxes are sperm oil, a liquid wax from the sperm whale, and spermaceti, a solid constituent refined from sperm oil (see WHALE); lanolin (see CHOLESTEROL), the principal constituent of the natural wool fat of sheep; and Chinese wax, the secretion of insect waxes. Vegetable waxes occur on the exposed surfaces of many plants, particularly on leaves, acting as a protection against excessive loss or gain of water by the plant. Some plants are a sufficiently abundant source of wax to have commercial importance. Among wax products from plants are wax myrtle (see BAYBERRY), used by early Americans in candlemaking; Carnauba wax, exported from Brazil (see CARNAUBA PALM); and Japan wax, extracted from an oriental species of sumac, and used as a substitute or adulterant for beeswax. The last-named substance is actually a fat, and not a wax. By contrast, wool grease or lanolin is a true wax. Ambergris (q.v.) is a valuable wax secreted in the intestines of sperm whales; found floating in tropical oceans, it is gathered for use as a fixative in perfumes. Paraffin wax is a mixture of saturated hydrocarbons of higher molecular mass, produced during the refining of petroleum (q.v.). Most commercial waxes now come from petroleum. A

WAXAHACHIE

native form of paraffin wax occurs as ozokerite, the refining of which produces commercial ceresin wax. Chlorinated paraffin waxes have come into considerable use because of their fire-resistant properties. Although vegetable waxes account for less than 5 percent of the total market, in dollar value they make up 25 percent of the total.

Waxes are used in the manufacture of candles for religious and decorative purposes, and in the manufacture of polishes, matches, waxed papers, phonograph records, and cosmetics. Waxes are employed also in the manufacture of rust-preventives, rubber antioxidants, electrical insulators, paper-coatings, printing inks, textile finishes, leather dressings, and waxed containers for food. This range of products requires waxes of different melting points, as well as of different gloss, hardness, tensile strength, water resistance, and ductility.

WAXAHACHIE, city in Texas, and county seat of Ellis Co., about 27 miles s. of Dallas. A marketing center mostly for cattle, the city also has some manufacturing. It is the site of Southwestern Assemblies of God College, founded in 1927. Waxahachie was founded in 1847, and incorporated as a city in 1871. Pop. (1960) 12,749; (1970) 13,452.

WAX MYRTLE. See BAYBERRY.

WAXWING, bird of the waxwing family, the Bombycillidae, native to the Northern Hemi-

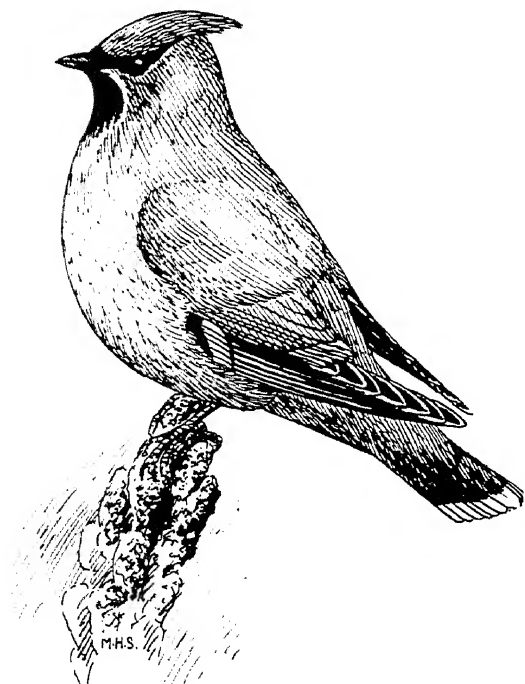
sphere. Waxwings are fawn-colored birds with erectile crests, silky-textured plumage, and long, pointed wings; the secondary wing feathers are tipped with red, horny scales resembling sealing wax. The common American species are the cedar waxwing, *Bombycilla cedrorum*, and the Bohemian waxwing, *B. garrula*. The cedar waxwing, known also as the cedar bird, is about 7 in. in length. It breeds from Canada to northern Georgia and northern New Mexico and winters south to Panama. Predominantly brown, its plumage is darker on the wings and tail, yellow on the underparts, and white on the under-tail coverts. The Bohemian waxwing is a slightly larger bird and has similar coloring, although it may be distinguished by the white bands on its wings and by the reddish-brown under-tail coverts. It breeds from northwestern Canada and Alaska to the southern parts of British Columbia and Alberta.

Waxwings feed on insects, fruit, and berries. Their nests are constructed of twigs, leaves, and bits of bark. The eggs number four to six in a clutch and are blue-gray in color, spotted with black and brown.

WAXWORK. See BITTERSWEET.

WAYCROSS, city in Georgia, and county seat of Ware Co., 95 miles s.w. of Savannah. It is an important railroad and highway center, a leading bright-leaf tobacco market, and the commercial center of an area in which tobacco, corn, sugar cane, cotton, pecans, livestock, lumber, and naval stores are the chief products. Industrial establishments in the city include railroad and machine shops, meat-packing plants, chick hatcheries, refrigerating plants, lumber mills, and plants processing naval stores. In the vicinity of the city is Okefenokee Swamp (q.v.), a vast marshy area covering about 660 sq.mi., one of the largest swamps in the United States and noted as a wildlife refuge. Waycross was settled in 1870, incorporated as a town in 1874, and chartered as a city in 1909. Pop. (1960) 20,944; (1970) 18,996.

WAYNE, township of New Jersey, in Passaic Co., on the Pompton, Ramapo, and Passaic rivers, 5 miles w. of Paterson. Included in the township are Mountain View, a resort community with adjoining nurseries and poultry, truck, dairy, and fruit farms; Preakness; the residential lake resorts of Packanack Lake, Pines Lake, and Lions Head Lakes; and several large suburban shopping plazas. Manufactures of the township include metal and plastic products, chemicals, electronic equipment, concrete products, and rubber goods. The Theunis Dey Mansion (1740), a reconstructed museum in Preakness Valley



Bohemian waxwing, *Bombycilla garrula*

Park, served as headquarters for General George Washington (q.v.) in 1780. Paterson State College (1885) is in Wayne, as is the Voice of America broadcasting station. Originally settled by English, Dutch, and Huguenot immigrants, the township was established in 1847 and was incorporated in 1960. Pop. (1960) 29,353; (1970) 49,141.

WAYNE, village of Michigan, in Wayne Co., about 10 miles w. of Dearborn. Manufactures include foundry products, earth-moving equipment, and automobile and aircraft parts. It is also an agricultural center. A State teacher's college and a State experimental farm are situated here. Wayne was settled in 1836 and incorporated as a village in 1869. Pop. (1960) 16,034; (1970) 21,054.

WAYNE, Anthony (1745–96), American soldier, born in Chester County, Pa., and privately educated in Philadelphia, Pa. In 1776, after the outbreak of the American Revolution (q.v.), he entered military service as commander of a Pennsylvania regiment assigned to cover the retreat of American forces from Québec, Canada. In 1777, after being promoted to brigadier general, he participated in the battles of Brandywine and Germantown and in 1778 distinguished himself in the Battle of Monmouth. His greatest achievement was a brilliant victory at Stony Point in 1779. In 1781 he contributed to the British defeat at Yorktown. Wayne retired to civilian life in 1783, but he returned to active duty in 1792 as a major general and commander in chief of the western army. In 1794 he defeated the Miami Indians (q.v.) in the Battle of Fallen Timbers, near the site of present-day Toledo, Ohio, and the following year he negotiated the Treaty of Greenville with them, opening the Northwest Territory (q.v.) to American settlers; see FORT WAYNE; INDIANA: *History*. Noted for his bravery and quick temper, Wayne was popularly known as "Mad Anthony". See separate articles on most of the battles mentioned.

WAYNESBORO, independent city of Virginia, not located within any county, but near the junction of the Augusta, Albemarle and Nelson county lines, and about 21 miles w. of Charlottesville. Manufactures include synthetic fibers, wood products, textiles, and furniture. Settled in 1700, Waynesboro was incorporated as a town in 1700, and as a city in 1797. Pop. (1960) 15,694; (1970) 16,707.

WAYNESBORO, borough of Pennsylvania, in Franklin Co., about 18 miles w. of Gettysburg. Rich with dairy farms and apple and peach orchards, Waynesboro is a processing and marketing area. Waynesboro also has varied manufac-

turing. Waynesboro was settled in 1797, and incorporated in 1818. Pop. (1960) 10,427; (1970) 10,011.

WAYNE STATE UNIVERSITY, coeducational State-controlled institution of higher learning, located in Detroit, Mich. The oldest unit of the university was founded in 1868. In 1933 a number of separate colleges operating as the colleges of the city of Detroit were brought into a university structure, and the name Wayne University was adopted in 1934. Wayne University became Wayne State University in 1956. The university divisions are schools and colleges of business administration, education, engineering, law, liberal arts, medicine, nursing, pharmacy and allied health programs, social work, health and physical education, urban extension, and Monteith College. The degrees of bachelor, master, and doctor are conferred. In 1973 the university libraries contained 1,480,776 bound volumes. In the same year enrollment totaled 33,909 students, and the faculty numbered 1900. The endowment of the university was \$5,498,295.

WEAKFISH, or SQUETEAGUE, common name for any of several marine acanthopterygian food fishes of *Cynoscion* and related genera, belonging to the family Sciaenidae. The weakfish receives its name from its weak, easily lacerated mouth. It is pale brown tinged with green above, and silvery along the sides and under parts. Numerous brown blotches, some of which form undulating lines, run downward or forward along the sides of the body. The fish average 5 lb. in weight and 2 ft. in length, but sometimes attain a weight of 30 lb. It spawns in May and June; the eggs, after being laid, are buoyed up by tiny oil drops and hatch in approximately 48 hr. From its shape and habit of biting at a hook, the weakfish is often called sea trout, and is sold in many markets under this name. The common weakfish, *C. regalis*, also known as gray trout, is found abundantly off the eastern coast of the United States, from Cape Cod to Florida, and is an important food fish.

WEALTH, in economics (q.v.), an accumulation of goods having economic value. In order to have economic value, an object must have utility. It must have, or be suspected of having, the capacity of satisfying some human want. Economic value is to be distinguished from desirability. Wealth can be increased simply by discovering some use for things previously not regarded as useful. Thus the discovery of uses for petroleum in the 19th century added enormously to wealth. Secondly, economic goods must be in scarce supply. Air does not normally

have economic value because it is free. Air that is conditioned by artificial means is economically valuable, however, because it is relatively scarce. Thirdly, economic goods must be transferable, that is, it must be possible to buy and sell them at definite market prices. Personal qualities such as honesty and good looks are not transferable. Though such qualities may help produce wealth, they are not items of wealth themselves. Finally, to be an item of wealth, an object must have measurable economic value. Because the only common unit of value today is money, the worth of goods must be expressible in monetary terms. Obviously, the value of personal charm cannot be so expressed. Some economists, however, regard a definite skill in performing a job as wealth, as such skill has a determinable market value.

Components of Wealth. In classifying wealth, it is useful to distinguish between producers' goods and consumers' goods; and, in each of these categories, between durable and nondurable goods. Among producers' durable goods are plants, machinery, and other fixed installations. Inventories of goods to be sold or in process of production constitute producers' nondurable goods. Together, producers' durable and nondurable goods constitute capital (q.v.), as generally understood. Food, clothing, and similar items of consumption are consumer nondurables; consumer durables are homes, furniture, and the like. Services are not included in estimated wealth as they cannot be stored. Services do, however, have economic value, whether as services to producer (for example, business accounting) or as services to consumers (for example, hairdressing and education).

Wealth and Income. Wealth must be distinguished from income. Both are composed of economic goods and services possessing utility, scarcity, transferability, and measurability. But whereas wealth is an accumulation, a stock existing at a certain instant of time, income is a flow of goods and services over a certain period of time. Wealth may be regarded as a lake, and income as a stream flowing into or through it. Thus 50 acres of farmland is wealth, whereas the crop in any given year is income. By the same token an accumulation of grain in storage is wealth. The difference between income received and income consumed, wasted, or depreciated, as when grain deteriorates, is the measure of wealth accumulation.

Personal Wealth. A person's holdings of currency, bank balances, mortgages, and corporate securities constitute part of his personal wealth as distinct from national wealth. These holdings

are, however, not items of social wealth, but only claims upon that wealth, that is, against the actual material objects that compose social wealth. To count a person's claims to wealth as part of social wealth would mean double counting, once as physical objects, for example, a house, and once again as claims against the same objects, for example, a mortgage. Economists accordingly estimate wealth by measuring the actual physical stock of assets. Information about claims upon wealth is of importance only as it relates to the distribution of wealth among persons and institutions.

In a period of inflation, private wealth may rise while its social value falls; the monetary value of a house, for instance, may rise in relation to other prices although it is actually deteriorating physically. To reach a valid measurement of wealth, monetary valuations must be deflated to real values, discounting the effects of changes in the purchasing power of money.

NATIONAL WEALTH

National wealth is the sum total of economic goods in the possession of the national, State, and local governments, business and nonprofit institutions, and the individual inhabitants of a country.

Development of the Theory of National Wealth. Systematic study of what constitutes a nation's wealth was begun in the 16th century by the mercantilists; see *MERCANTILE SYSTEM, THE*. They advanced the thesis that a nation's stock of precious metals forms the most important part of its wealth. This view was generally accepted until the 18th century, when a reaction against the narrowness of mercantilist doctrine set in. It became evident that precious metals, particularly in the form of currency, were claims upon wealth rather than wealth itself. Mercantilist doctrine was gradually replaced by the view of the Physiocrats, a group of French economists of the 18th century, that only farming, mining, fishing, and other extractive industries could contribute to the real wealth of nations. The great Scottish economist Adam Smith (q.v.) broadened the Physiocratic concept by stressing that wealth not only can be extracted but also can be created by manufacturing. This view was systematically formulated in the 19th century by the British economist John Stuart Mill (see *under MILL*). Mill's formulation, with certain relatively minor modifications, is the one generally accepted today.

According to the modern version of Mill's concept, a nation's wealth comprises only its measurable physical assets, that is, its land and other natural resources; the structures, roads,

and other improvements on the land; the machinery and other durable goods used in production and distribution; inventories of goods in the possession of enterprises; and the goods accumulated at any one time in the hands of consumers. Paper money and securities are not included in estimates of a nation's wealth, because such assets are only claims against the physical assets actually constituting wealth. Holdings of money and securities are counted, however, when these holdings represent claims against governments or nationals of foreign countries. If a nation's aggregate claims against foreigners exceed the claims of foreigners against the nation and its inhabitants, the difference is a net addition to national wealth. If claims by foreigners exceed claims against foreigners, the difference is a net decrease of national wealth.

In the 19th century statisticians frequently considered the advisability of reckoning manpower as a part of national wealth, but almost all present-day economists reject such a concept. Definite skills, however, have a determinable market value. Currently, economists tend to give consideration to such items in socio-economic accounting.

Examples of factors that contribute to wealth but are not considered as wealth are the good will and similar intangible assets of a firm, the institutions and traditions of a nation, and such attributes of a people's character as pride of workmanship or the willingness to accept industrial discipline.

Assessing Value. In addition to problems of deciding what categories of wealth to include in estimates of national wealth, serious difficulties develop in assessing values. These difficulties arise because only a small part of a nation's wealth is traded on the market in any given year and the market values of shares, real estate, and other assets may show considerable fluctuations from year to year. In evaluating national wealth economists have used two approaches, the subjective and the objective.

SUBJECTIVE EVALUATION. In the subjective approach, a nation's wealth is measured by summing up individual estimates of the worth of individual possessions, as reported on tax returns and other official documents. The subjective approach depends a great deal upon personal honesty and upon the completeness with which the various forms of wealth are covered by tax returns and other required reports.

OBJECTIVE EVALUATION. The objective approach requires that disinterested and qualified outsiders estimate the aggregate value of particular pos-

sessions. Values at market prices are difficult to obtain for the reasons given above. Values shown in companies' books are invalid because prices may fluctuate substantially after the asset is acquired and entered in the books. Even when prices remain the same, allowances made by a company for depreciation and obsolescence may be, for internal financial reasons, either higher or lower than those which objectively should have been allowed. The best method open to statisticians is to estimate, in prices of the present day or of some fixed base date, the values of all existing assets and then to reduce these values by applying appropriate rates of depreciation and obsolescence. Sometimes the subjective and objective bases of evaluation can be used concurrently and the results checked against each other. Such figures are approximate in any event and must be used with caution.

Wealth of the United States. Calculations of national wealth fell into disfavor as national income accounting focused on use value as a basic of measurement of economic growth. The government of the United States, which has developed the most detailed and accurate economic statistics of any nation in the world, abandoned its efforts to evaluate the nation's wealth in 1922. Unofficial estimates for later years, however, have been made. The voluminous data on wealth contained in *Study of Savings in the United States* (3 vols., 1955), by the American economist Raymond W. Goldsmith (1904–), helped to clarify the situation in the U.S. and encouraged similar work in other countries.

A more recent study, prepared by the Securities and Exchange Commission, was published in 1971. The results are given in the tables on the next page. Between 1900 and 1968 (excluding Alaska and Hawaii), the national wealth, calculated on a current dollar basis, more than tripled. Although these figures are only rough approximations, they do indicate that the national wealth of the U.S. stands well above that of any other country and accounts for a large part of the total wealth of the whole world. In these tables, certain definitions should be noted. National wealth is composed of reproducible assets, nonreproducible assets, and net foreign assets. Reproducible assets includes all types of buildings, producer durables, consumer durables, inventories that businesses have at any given time, and monetary metals. Nonreproducible assets are various types of land holdings. Net foreign assets comprise the difference between assets owned by U.S. citizens in foreign

WEALTH

countries and the assets owned by foreigners in the U.S. Apart from land, the total wealth of the U.S. was found to amount to slightly more than the value of the national product for three years. National product is the amount of goods and services produced during a year. Since 1900 the ratio of national wealth to national product appeared to show a declining trend. These results were confirmed by more detailed examination of American statistics of capital used in manufacture and also by the statistics of other countries. In economically advanced countries the amount of capital required per worker is increasing, but the amount of output is increasing faster than the amount of capital. These results, however, do not apply to underdeveloped countries.

In recent years the U.S. had added to its real wealth at the rate of about 4 percent per annum. In the Soviet Union and other Communist countries where the state owns much of the national wealth and exercises complete control over the productive process, certain institutions and practices had developed that provide a substantially higher rate of wealth accumulation

NATIONAL WEALTH,¹ IN CURRENT AND CONSTANT (1947-49) DOLLARS

Item		1929	1948	1958	1968
Current dollars					
National wealth, total	billions	439	928	1,703	3,079
Net national product	billions	98	250	417	790
Ratio of total wealth to net national product		4.5	3.7	4.1	3.9
1947-49 dollars					
National wealth, total	billions	778	883	1,244	1,847
Population	millions	122.4	147.9	175.6	200.7

¹ Wealth data should be regarded as approximate only.

NATIONAL WEALTH: PERCENT DISTRIBUTION, BY TYPE OF ASSET, 1929 TO 1968

Type of Asset	1929	1948	1958	1968
Total	100.0	100.0	100.0	100.0
Reproducible assets	71.3	79.3	80.4	75.0
Structures	43.2	48.4	49.0	48.3
Residential	21.8	25.2	24.2	22.2
Business	14.8	12.4	13.4	14.9
Public and other	6.6	10.7	11.4	11.2
Other	28.1	30.9	31.4	26.7
Producer durables	8.7	9.4	11.7	12.2
Consumer durables	9.6	9.2	10.5	7.6
Business inventories	8.7	9.3	7.6	6.5
Monetary metals	1.1	3.0	1.5	.45
Nonreproducible assets	25.8	19.3	18.3	23.2
Agricultural land	8.7	6.4	5.9	4.9
Business land	5.2	4.2	4.0	6.3
Residential land	8.2	5.0	5.5	7.3
Public and other land	3.8	3.7	2.8	4.7
Net foreign assets	2.8	1.4	1.4	1.8

than that of the U.S. or any other major non-communist country. Nevertheless, despite the faster rate of growth, the level of average wealth per capita in the Soviet Union compared with that of the U.S. in 1880. C.G.C. & M.R.G.

WEAPONS. See ANTI-AIRCRAFT WEAPONS; ARCHERY; ARMY; ARTILLERY; BAZOOKA; BOW; CANNON; CROSSBOW; GUIDED MISSILES; GUNPOWDER; MACHINE GUN; MINE; NAVY; NUCLEAR WEAPONS; ROCKET; SPEAR; SWORD; WARFARE.

WEASEL, common name for small, fur-bearing, carnivorous mammals of the genus *Mustela*, belonging to the family Mustelidae, and comprising numerous species and subspecies. They are most abundant in North America and Europe, but also occur in South America, northern Africa, and Asia. The various species are very similar in appearance and habits. Weasels are lithe, slender animals with elongated necks, muscular, snakelike bodies, and short legs. They vary from 5 to 16 in. in length, and the male is larger than the female. Their heads are small and triangular with pointed snouts. Nearly all weasels are brown above and white beneath, and those found in northern regions turn white in the winter; see ERMINE. In warmer regions weasels retain their brown coat throughout the year.

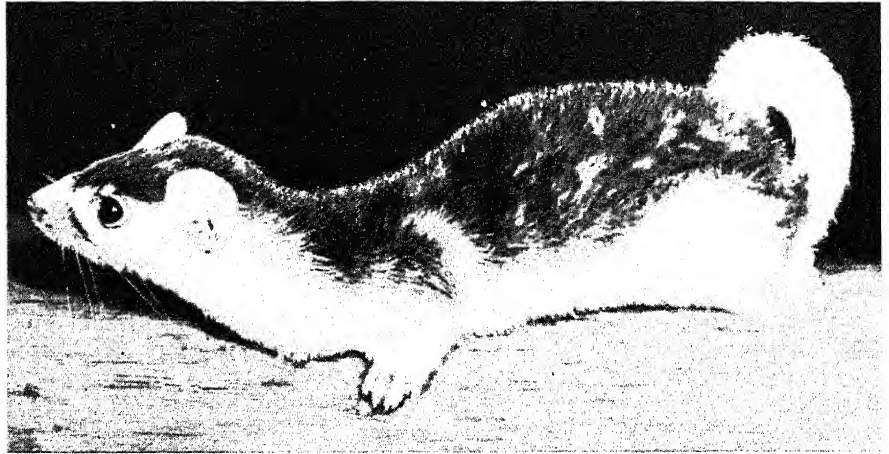
The weasel is a fearless, bloodthirsty creature which preys on mice, rats, birds, and rabbits. It is largely nocturnal. Extremely agile and swift, it attacks animals larger than itself. Though sometimes a serious threat to poultry, it performs useful service to the farmer by devouring rodents around barns and granaries. When taken young, it is capable of being tamed. The female weasel makes a nest of straw, leaves, and moss in a ground crevice or a hollow tree. A litter has four or five young.

Among the best-known American species are the Arctic weasel, *M. erminea*, known also as the stoat or ermine; the longtail weasel, *M. frenata*, common throughout the United States and Mexico; and the mink, *M. vison*, native to eastern and northern U.S. and Canada. The black-footed ferret, *M. nigripes*, the largest of the weasels, is native to the Rocky Mountain region, where it is known as the prairie-dog ferret because its chief prey is the prairie dog (q.v.). Other weasels also are called ferrets, and polecat (q.v.) is another name for some species; see FERRET.

WEATHER. See CLIMATE; METEOROLOGY. For information on various weather phenomena, see CLOUD; CYCLONE; DEW; FOG; HAIL; HURRICANE; RAIN; SLEET; SMOG; SNOW; TORNADO; WIND.

WEATHER FORECASTING. See METEOROLOGY: *Weather Forecasting*; WEATHER SERVICE, NATIONAL.

Eastern weasel, *Mustela
noveboracensis*
New York Zoological Society



WEATHERING, in geology (q.v.), processes of physical disintegration and chemical decomposition of solid rock materials at or near the earth's surface. Physical weathering breaks up rock without altering its composition, and chemical weathering decomposes rock by slowly altering its constituent minerals. Both processes work together continuously to produce debris that is then transported away mechanically or in solution; see *EROSION: Geological Erosion*. Weathering processes also aid in the formation of soil; see *SOILS AND SOIL MANAGEMENT*.

The chief factors involved in physical weathering are temperature changes, such as intense heat, frost action involving the growth of ice crystals from water seeping and freezing in rock crevices and cracks, and living organisms, such as tree roots and burrowing animals. Temperature changes alternately expand and contract rocks, causing granulation, flaking, and massive sheeting of the outer layers. Frost action and organisms widen cracks, exposing deeper layers to chemical weathering.

Chemical weathering alters the original mineral composition of rock in a number of ways, including solution in water and weak soil acids, by oxidation (q.v.), by producing a reaction with carbon dioxide, and by hydration, which is a process in which water chemically combines and reacts with minerals. Plants, such as lichens (q.v.), also decompose certain rocks by extracting soluble nutrients and iron from the original minerals.

See also *GEOLOGY: Geomorphology*.

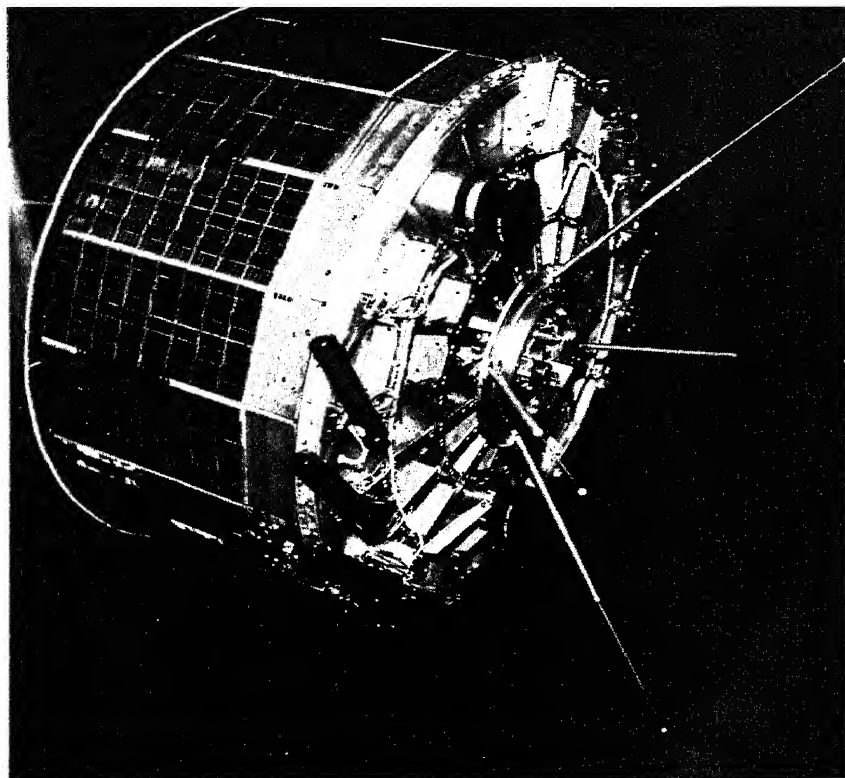
WEATHER SATELLITE or **METEOROLOGICAL SATELLITE**, unmanned space vehicle that orbits the earth and carries equipment to observe and report weather conditions on a global basis.

Weather satellites carry television cameras

and infrared (heat) scanning radiometers to observe clouds and weather conditions on the earth below the satellites. The television pictures and the scanning radiometer data are telemetered (radioed) automatically to receiving stations on earth. The radiometer data provide infrared photography of the clouds, the atmosphere, and the surface of the earth.

The television and infrared pictures derived from satellites, together with conventional meteorological data obtained from weather stations on earth, form the basis for studies of weather phenomena and forecasts of weather conditions throughout the world. The advantage of weather satellites over other methods for acquiring meteorological data is that the satellite's equipment can scan large areas of the surface of the earth at one time and can collect useful weather information over the entire globe in a relatively short period. For example, Tiros I, the first weather satellite, launched by the United States on April 1, 1960, with a perigee (minimum) altitude of 430 mi. and an apogee (maximum) altitude of 468 mi., circled the earth every 99.2 min. With the aid of high-speed electronic computers, scientists in the early 1970's expected that they would soon have the ability to predict weather reliably some two weeks in advance.

Through the World Meteorological Organization, the U.S. provides automatic picture transmission (A.P.T.) data from U.S. weather satellites to about thirty-seven countries. The ESSA and NOAA series of weather satellites launched by the U.S. in the late 1960's and early 1970's carried sophisticated scanning and vertical temperature-profile (VTP) radiometers, high-resolution radiometers, and solar-proton monitors among other sensing devices. These satellites provide vital meteorological information to forecasting



The Tiros X weather satellite, programmed to photograph the breeding areas of hurricanes and tropical storms. NASA

stations throughout the world and also provide invaluable global atmospheric, climatic, and weather data to scientists working on the advanced Global Atmospheric Research Program (GARP). In GARP, thirty-seven countries are co-operating in an effort to use a worldwide network of satellites, computers, and high-speed telecommunications facilities to establish a reliable global observing system and to provide sufficient data to utilize the full predictive capability of modern computers and sophisticated meteorological instruments. See METEOROLOGY; SATELLITE, ARTIFICIAL.

WEATHER SERVICE, NATIONAL, formerly UNITED STATES WEATHER BUREAU, United States government agency engaged in reporting, predicting, and studying weather, including temperature, moisture, barometric pressure, and wind speed and direction, throughout the U.S. and its territories. See METEOROLOGY: *Weather Forecasting*. Established in 1870 under the direction of the Signal Corps of the United States Army, the Weather Bureau was transferred to the Department of Agriculture in 1891 and to the Department of Commerce in 1940. In 1965 it was made a branch of the Environmental Science Services Administration within the Department of Commerce. Under the Reorganization Plan of 1970, the Weather Bureau became a part of the new National Oceanic and Atmospheric Administration (q.v.) in the Department of

Commerce and was officially renamed the National Weather Service.

Data-Gathering Stations. As many as 300 full-time offices, or field stations, are maintained by the Weather Service throughout the U.S. and its possessions. Observations are recorded at the stations every one to six hours. Detailed, comprehensive reports made by the stations are supplemented by reports from stations of other agencies; these include approximately 300 airport offices of the Federal Aviation Administration and about 70 ships and coastal stations assigned to the United States Coast Guard. Most of the supplementary field stations send reports every hour, enabling the Weather Service to furnish information necessary for the operation of airlines. From the reports made every three hours, weather maps, that is, simplified maps or charts showing the principal weather conditions at a given hour over an extended area, are prepared. For more long-range studies of the phenomena of climates, the Weather Service receives statistics from 13,000 volunteer weather observers who keep daily records of air temperature, rainfall, and in some cases river stages and tides. The activities of these various field stations and individuals are coordinated by six regional offices, four supervising the contiguous forty-eight States, and one each for Alaska and the Pacific Ocean area.

Weather Forecasts. Weather Service field sta-

tions provide weather forecasts, warnings, and advice to the general public, as well as to specialists in agriculture, business, commerce, and industry. Regular forecasts are made available three times each day, covering developments expected during the ensuing thirty-six- to forty-eight-hour period. Emergency warnings of storms and cold waves may be issued as the need arises. The forecasts and warnings are regularly printed in daily newspapers and broadcast by commercial television and radio stations throughout the U.S. In many cities local weather information for the public is continuously transmitted by the agency itself over special radio. By means of the automatic telephone-forecast repeater, installed and maintained in more than a score of major cities by the operating telephone company, millions of Americans can obtain weather forecasts merely by dialing an easy-to-remember telephone number. The service also issues a forecast each day projecting weather conditions for the succeeding five days, and a thirty-day outlook is issued twice monthly in Washington, D.C.

Special Services. In addition to regular forecasts to the public, the Weather Service provides certain specialized information. Aviation weather forecasts are issued to assist aircraft operating in the U.S. and over transoceanic routes. Tracking storms at sea and on the Great Lakes is the province of the marine meteorological service. A closely related function is performed by observation centers in the Tropics, which, as part of the hurricane and storm-warning service, issue vital advice and warnings from June through October, the critical hurricane season.

During the severely dry season, rangers and campers in forested regions are also guided by a special service. Another important activity is the river-and-flood forecasting system; daily observation of river levels and rainfall amounts at some 8000 stations results in extremely accurate predictions and a high degree of protection for those who live or work on the banks of America's rivers and streams. Finally, the importance of agricultural production to the nation's economy is attested to by the existence of weather services to farmers and ranchers for frost warnings and spraying advice, and the climatological and crop-weather services, which distribute statistical summaries of climatological data and weekly reports on crop progress.

Research. In addition to its regular and special services to the public, the Weather Service conducts research projects. In its meteorological investigations, primarily concerned with forecasting techniques and storm behavior, the agency

works closely with various government research laboratories. It utilizes in its forecasting services the findings from studies of mathematical modeling of the general circulation of the atmosphere, advances in radar meteorology, high-speed computer methods, and earth-orbiting artificial satellites. Most of the results of the research and the general observational data obtained are made available in the many publications of the Weather Service.

WEAVER, Robert Clifton (1907–), American economist and government official, born in Washington, D.C. He received his B.S., M.A., and Ph.D. degrees from Harvard University and began his governmental career in 1933 as an adviser on Negro affairs for the Department of the Interior. He left that position to serve with the Federal Housing Authority (1937–40) and the War Production Board (1940–44). Weaver was later an administrator of New York State and New York City housing programs (1954–61) and headed the Federal Housing and Home Finance Agency (1961–66). From 1966 through 1968 he was secretary of the Department of Housing and Urban Development (q.v.) under President Lyndon Baines Johnson (q.v.), and thus the first Negro cabinet official in the history of the United States. After retirement from the government, he was president of Bernard M. Baruch College of the City University of New York (1969–70). Formerly the chairman of the National Association for the Advancement of Colored People, Weaver wrote *Negro Labor: A National Problem* (1946), *The Negro Ghetto* (1948), and *Dilemmas of Urban America* (1965).

WEAVERBIRD, general name for any of numerous Old World birds of the weaver-finch family, Ploceidae, noted for weaving elaborate, covered nests. Most weaverbirds are the size of sparrows (see SPARROW); however, the tail feathers of the breeding male long-tailed whydah, or widow bird, *Euplectes progne*, are so long as to impede flight. The male of most species of weaverbird is brightly colored; the female is plainer. The eggs, which vary in number from species to species, are usually white but sometimes blue, green, spotted, or speckled.

A well-known species of weaverbird is the pink-billed Java sparrow, *Padda oryzivora* of Indonesia, a popular cage bird. Its coloring is black, white, and gray. Another, the so-called sociable weaver, *Philetairus socius*, of South Africa, builds a communal umbrella-shaped nest of sticks and straw, in which as many as 300 pairs may breed.

About 200 species of weaverbird are found in Africa, and some 75 more are indigenous to

WEAVING

India, Malaysia, the Philippines, Australia, and various Pacific islands. The well-known house sparrow (q.v.) is a member of the weaverbird family, although not typical.

WEAVING. See **LOOM**.

WEBB, name of two prominent British economists, historians, and social reformers, who were husband and wife: **Beatrice Webb** (1858–



Beatrice Webb

UPI

1943) and **Sidney James Webb**, 1st Baron Passfield (1859–1947).

Beatrice Webb was born Beatrice Potter in Gloucestershire, England, and educated privately. About 1888 she became a socialist while working on a study of poverty in London with the British writer Charles Booth (q.v.). Sidney James Webb, born in London, was educated in Switzerland and Germany and at the City of London College. A civil servant from 1878 to 1891, he helped found the socialist Fabian Society (q.v.) in 1885.

The Webbs, married in 1892, campaigned together for various social reforms and, as leading figures of the Fabian Society, began to exert a strong liberalizing influence on British public opinion. They studied several fields in depth, at-

tempting in particular to advance British trade unionism, reform of Britain's poor-law system, and development of the educational system in London. In 1895 they helped establish the London School of Economics. In the early years of the 20th century, their leadership was instrumental in the formation of Britain's Labour Party. They founded the Labour Party weekly *New Statesman* in 1913. Webb was elected to Parliament in 1922 as a member of the Labour Party. In 1924 he became president of the Board of Trade in the first British Labour cabinet. He was elevated to the peerage in 1929, thereby gaining representation for the Labour Party in the House of Lords. Webb served as secretary of state for the colonies (1929–31) in the second Labour government.

The Webbs together authored a number of books, the result of their joint studies; these include *The History of Trade Unionism* (1894), *English Local Government* (9 vol., 1906–29), *The Decay of Capitalist Civilization* (1923), and *Soviet Communism: A New Civilization?* (2 vol., 1935), a favorable appraisal of the Soviet system. Webb also wrote *Fabian Essays* (1889), with the British dramatist George Bernard Shaw (q.v.), and *Socialism in England* (1890). Mrs. Webb was the author of *The Cooperative Movement in Great Britain* (1891), *My Apprenticeship* (1926), and *Our Partnership* (published posthumously, 1948).

WEBER, name of a distinguished family of German scientists, the most prominent of whom were the following two brothers.

Ernst Heinrich Weber (1795–1878), anatomist and physiologist, born in Wittenberg, and educated at the University of Leipzig. He served as professor of anatomy (1818–78) and professor of physiology (1840–78) at the University of Leipzig. Weber is well known as an anatomist but his greater fame rests upon his pioneer work in the exploration of the sense organs and the sensitivity of the skin, and his studies of acoustics and wave motion (qq.v.). Weber's study of the ear and the sensations of pressure and temperature of the skin marked the beginning of experimental psychology. His law of sensation, called Weber's law, which formulated the mathematical relationship between stimulus and the resultant sensation, was the first valid generalization in psychophysics. Although no longer accepted, his work was both original and important at the time. See **PSYCHOLOGY**, **EXPERIMENTAL**: *Sensory Psychophysiology*.

Wilhelm Eduard Weber (1804–91), physicist, born in Wittenberg, and educated at the universities of Halle and Göttingen. He became pro-

fessor of physics at the University of Göttingen in 1831 and in 1837 was expelled, with six of his colleagues, for protesting against suspension of the constitution of Hannover by the new king Ernest Augustus (1771–1851); see HANNOVER. He held the chair of physics at the University of Leipzig from 1843 to 1849, when he was restored to his former position in Göttingen.

Weber made a significant contribution to the study of electricity and magnetism (qq.v.), and was the first to discover the connection between electric and magnetic power. His most important achievement was the development of the absolute system of electrical units (q.v.). He collaborated with the German mathematician Karl Friedrich Gauss (q.v.) to establish an electricity-measuring system based on Gauss' magnetic units which are now in international use. The two men also developed an electromagnetic telegraph in 1833. In addition, Weber was associated with his brother Ernst in the publication (1825) of an important treatise on wave motion and in important research into acoustical phenomena. The practical unit of magnetic flux was named the weber in his honor.

WEBER, Carl Maria Friedrich Ernst von (1786–1826), German composer, pianist, and opera conductor, the son of Baron Anton von Weber (1734–1812), an army officer and violinist. Born in Eutin, near Lübeck, Weber began at an early age to study music. Among his teachers was the German composer Michael Haydn (1737–1806), the brother of Franz Joseph Haydn (q.v.). At the age of thirteen Weber made his debut as a pianist and wrote his first opera. At eighteen he secured the position of operatic conductor at Breslau. Between 1806 and 1810 he was successively music director and private secretary for members of the German nobility. Later he traveled extensively, giving concerts. His musical compositions and engaging personality made him highly popular wherever he went. The compositions of this period include the operas *Silvana* (1810) and *Abu Hassan* (1811).

Weber's first really important appointment came in 1813, when he was chosen conductor of the Prague opera. He revitalized that musical organization and established it on a sound basis. In 1816 he became director of the newly organized German opera company in Dresden, where Italian opera had long reigned supreme. In this post, which he retained until his death, Weber succeeded in establishing an institution for the promotion of German dramatic art.

Weber's reputation as a composer rests chiefly upon three operas, *Der Freischütz* ("The Free-Shooter", 1821), *Euryanthe* (1823), and *Oberon*

(1826). At its premier performance *Der Freischütz* won a wildly enthusiastic reception; few operatic works have received such instantaneous acclaim. With this opera, based upon German national folklore and combining legendary and supernatural elements, Weber established the Romantic school of German opera. *Euryanthe*, the only one of his operas without spoken dialogue, was far less successful. *Oberon*, commissioned for the Covent Garden Theatre (q.v.) in London, had an English libretto; Weber learned English expressly for this commission. Although he was tubercular and in failing health, he went to London to direct the production of *Oberon*. He died there only a few weeks after the premiere of the opera, which was received with great enthusiasm.

Weber developed a number of musical innovations, including the use of leitmotifs, the use of the recitative in place of spoken dialogue, and the achievement of effect through exaggerated musical writing and through brilliant orchestral coloring. His influence was particularly great upon the German composer Richard Wagner (q.v.), whose admiration for Weber was unbounded. Weber wrote more than 250 musical compositions, which include, in addition to operas, two symphonies, lieder, ballads, part-songs, a number of piano and clarinet concertos, cantatas and masses, and solo piano music including the famous *Aufforderung zum Tanz* ("Invitation to the Dance", 1819).

See MUSIC: *History: The Romantic Era*; see also ROMANTICISM: *Music*.

WEBER, Max (1864–1920), German economist and social philosopher, born in Erfurt, and educated at the universities of Heidelberg, Berlin, and Göttingen. A jurist in Berlin (1893), he subsequently held professorships in economics at the universities of Freiburg (1894), Heidelberg (1897), and Munich (1919). He was editor of the *Archiv für Sozialwissenschaft und Sozialpolitik*, the German sociological journal, for some years. Challenged by the Marxist theory of economic determinism, Weber combined his interest in economics with sociology in an attempt to establish, through historical study, that historical causation was not influenced merely by economic considerations; see MARX, KARL. In one of his best-known works, *Die Protestantische Ethik und der Geist des Kapitalismus* (1904–05; Eng. trans., *The Protestant Ethic and the Spirit of Capitalism*, 1930), he tried to prove that ethical and religious ideas were strong influences on the development of capitalism (q.v.). He expanded on this theme in *Gesammelte Aufsätze zur Religionssoziologie* (3 vol., 1920–21; Eng.

trans., *The Religions of the East Series*, 1952–58). There he postulated that the prevailing religious and philosophical ideas in the Eastern world prevented the development of capitalism in ancient societies, despite the presence of favorable economic factors. Overall, he tried to show that world history can be treated systematically and attempted to account for the unique development of Western civilization.

WEBER, Max (1881–1961), American painter, born in Białystok, Russia (now in Poland), and educated at Pratt Institute, Brooklyn, N.Y. He was brought to the United States by his parents in 1891. In 1905 he went to Paris, where he studied with the French artists Henri Laurens (1885–1954) and Henri Matisse (q.v.). He returned to the U.S. in 1909. His early paintings received little praise from American critics, but with the growing acceptance of modern art, his work won increasing favor.

Weber's style varied widely over the years. His early work derived predominantly from fauvism and cubism (qq.v.). In the 1920's and 1930's his paintings became more representational. His later style tended to be abstract and expressionist (see **EXPRESSIONISM**), with stress on brilliant color, intricately organized linear design, and violent distortions charged with emotion. It is rich in poetic and mystic feeling, particularly in the paintings from Jewish life for which he is best known.

Weber won distinction also as a writer on the theory and history of art. His principal writings are *Cubist Poems* (1914), *Essays on Art* (1916), and *Primitives* (1927).

WEBERN, Anton von (1883–1945), Austrian composer and conductor, born in Vienna, and educated at the University of Vienna. He was a pupil and early disciple of the Austrian composer Arnold Schönberg (q.v.) and adopted his methods and theories, especially the use of the twelve-tone system (q.v.). During his professional career Webern conducted opera and theater orchestras in various cities of Germany and in Prague, taught composition at the musical academy founded by Schönberg in Vienna, and introduced the works of contemporary musical innovators. His compositions are characterized by extreme condensation, brevity, great clarity and delicacy, and fragmentary melodic units; their appeal is chiefly intellectual. Webern's works include a *Passacaglia* (1908) and *Six Pieces* (1909) for orchestra; a set of *Geistliche Lieder* ("Sacred Songs", 1924) for soprano and instrumental quintet; various chamber-music works, among them a *Symphony for Chamber Orchestra* (1928); and choral works.

WEBSTER, Daniel (1782–1852), American statesman and orator, born in Salisbury (now Franklin), N.H., and educated at Dartmouth College. Webster studied law in Salisbury and Boston and was admitted to the bar in 1805. Two years later he established a law practice in Portsmouth, N.H. There he became active in politics and joined the Federalist Party (q.v.). Like many New Englanders, Webster resented the predominance of Virginians in the national government and opposed the War of 1812 (q.v.). From 1813 to 1817 he served as a member of the United States House of Representatives and eloquently defended Federalist principles.

In 1816 Webster moved to Boston and the following year he returned to the practice of law. Between 1817 and 1823 he won several famous Constitutional cases before the Supreme Court of the United States (q.v.), notably the Dartmouth College case (1819), which established the precedent that no legislature has the right to impair the obligations imposed by a contract, and *McCulloch vs. Maryland* (1819), which denied the right of the States to tax an institution established by the Federal government. Thereafter Webster was generally regarded as one of the leading lawyers of the country.

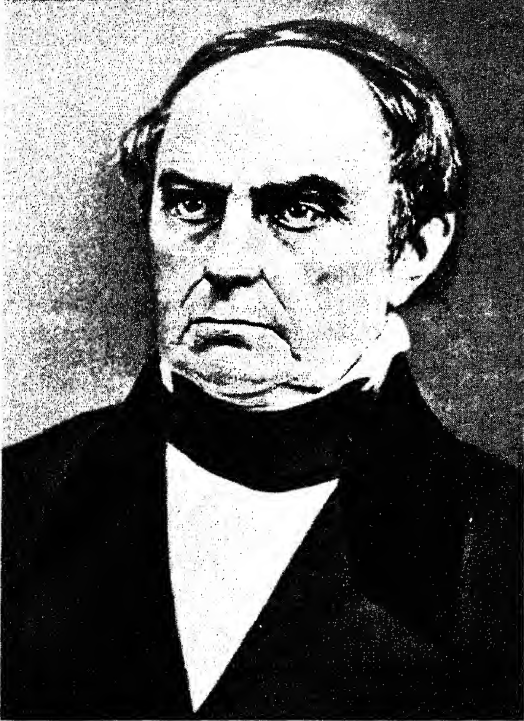
An Eloquent Speaker. Webster's eloquence as a speaker at public gatherings and in court established him as a great orator. Two of his best-known orations are the Plymouth speech (1820), commemorating the bicentennial of the landing of the Pilgrims, and the Bunker Hill speech (1825), marking the fiftieth anniversary of the famous American Revolution battle.

Webster was elected to the U.S. House of Representatives from Boston in 1822 and to the United States Senate from Massachusetts in 1827. He had opposed legislation for a protective tariff in 1816 and did so again in 1824. Under the influence of expanding New England industrial interests, however, Webster abandoned his free-trade position. He supported the tariff of 1828 (see **TARIFFS, UNITED STATES**) and became a protector of Northern industrial interests on other issues as well.

In 1830 his eminence as an orator reached its culmination in his reply to the speech of Robert Young Hayne (q.v.), Senator from South Carolina, on the nature of the Union and the States' right of nullification (q.v.). Webster successfully combated the theory of nullification and ably vindicated the nationalist view of the Union. In the controversy over the renewal of the charter of the United States Bank, Webster advocated renewal and opposed the financial policy of President Andrew Jackson (q.v.) in general (see

BANKS AND BANKING). Many of the principles of sound finance developed by his speeches at this time were later incorporated in the Federal Reserve System (q.v.).

A Political Leader. The Whig Party (q.v.) began in 1834. Webster became one of its leaders, and in 1836 he received the electoral vote of



Daniel Webster

National Archives

Massachusetts for President. In 1841 Webster was appointed secretary of state by President William Henry Harrison, a position he retained under President John Tyler (qq.v.). In that capacity he negotiated the Webster-Ashburton Treaty (1842), which settled the dispute with Great Britain over the boundary between the U.S. and Canada; see NORTHEAST BOUNDARY DISPUTE. He resigned from the cabinet in 1843.

In 1845 Webster reentered the Senate. He opposed the annexation of Texas and the war with Mexico. Although Webster was personally opposed to slavery (q.v.), he believed first and foremost in the preservation of the Union. His last years in the Senate were devoted to efforts to maintain peace between the North and South by means of compromise. His last great speech was delivered on March 7, 1850, in support of the Compromise Measures of 1850 (q.v.). The speech aroused indignation in the North because of its concessions to slavery.

In 1850–52 Webster was secretary of state in the cabinet of President Millard Fillmore (q.v.). The orator died at his home in Marshfield, Mass., on Oct. 24, 1852.

WEBSTER, John (1580?–1625?), English playwright. Virtually nothing is known about his life, until shortly after 1600 when he found employment as one of a group of dramatists writing plays for the London theater manager Philip Henslowe (d. 1616). The group included many gifted Elizabethan playwrights, among them Thomas Dekker, Michael Drayton, John Marston, and John Heywood (qq.v.), with each of whom Webster collaborated occasionally. Webster's genius as a writer was first fully revealed in his great tragedies *The White Devil*, produced in 1612, and *The Duchess of Malfi*, staged about 1614. Both plays depict a world of extravagant passions, dark intrigue, and fratricidal violence. Despite their melodramatic themes, Webster's plays are redeemed by his soaring poetic dialogue and his grasp of human psychology. See ENGLISH LITERATURE: *The Renaissance: Shakespeare*.

WEBSTER, Noah (1758–1843), American lexicographer, born in West Hartford, Conn., and educated at Yale College (now Yale University). He served in the American Revolution, studied law, and in 1781 was admitted to the bar in Hartford, Conn. As a law student and after passing his bar examination he taught school. In 1783 he published a spelling book, known later as *Webster's Elementary Spelling Book* or *The Blue-Backed Speller*, the first part of his *A Grammatical Institute of the English Language*. The second part of the *Institute*, a grammar, was published in 1784, and the third part, a reader, in 1785. One purpose served by the *Institute* was to differentiate American English from British spelling, grammar, and pronunciation. A century later it was estimated that more than 60,000,000 copies of the speller had been sold; in revised form it is still in print.

A dedicated member of the Federalist Party (q.v.), Webster issued a pamphlet, *Sketches of American Policy*, in 1785; in this he recommended adoption of the proposed United States Constitution. Webster was also a leading proponent of copyright laws and influential in securing passage of the first copyright legislation by the United States Congress in 1790. Settling briefly in New York City in 1793, he founded a daily newspaper, *The Minerva* (later *The Commercial Advertiser*), and a semiweekly, *The Herald* (later *The Spectator*), both in support of the Federalist Party. By 1803 he had settled in New Haven, Conn., and left journalism.

WEBSTER-ASHBURTON TREATY

During this period he wrote *A Brief History of Epidemic and Pestilential Diseases* (2 vol., 1799), long the standard work on the subject; several works on politics, economics, and physical science; and his first small lexicographical work, *A Compendious Dictionary of the English Language* (1806).

From 1812 to 1822 Webster lived in Amherst, Mass., where he helped to found Amherst College (q.v.). In 1825, having devoted more than twenty years to the study of the English language and having traveled in both England and France, Webster returned to New Haven to complete his *American Dictionary of the English Language*. The first edition of this monumental work was published in two volumes in 1828. It contained 12,000 more words and about 40,000 more definitions than any earlier dictionary of the English language.

Evaluation of Webster. Webster's importance does not rest only upon the size of his work. He was also the first to emphasize American rather than British usage and the first to list senses in the chronological order in which they made their appearance in the language. His etymologies were not wholly accurate by modern standards, but his precise definitions are models of lexical style. Also, by the inclusion of thousands of technical and scientific terms, Webster laid the groundwork for the modern comprehensive, rather than purely literary, dictionary.

An enlarged edition of Webster's dictionary was issued in 1840; it has appeared in several later revisions. *Webster's Third New International Dictionary* (1966) and an abridgement, *Webster's Seventh New Collegiate Dictionary* (1967), are the latest of these revisions.

See **DICTIONARY**.

WEBSTER-ASHBURTON TREATY. See **NORTH-EAST BOUNDARY DISPUTE**.

WEBSTER GROVES, city of Missouri, in Saint Louis Co., adjoining the city of Saint Louis, of which it is a residential suburb. It is the site of Webster College (Roman Catholic), established in 1915, an affiliate of Saint Louis University; the German Evangelical Missouri College, a theological seminary established in 1850; and the Eden Theological Seminary (Protestant). Webster Groves was incorporated in 1896 and chartered as a city in 1914. Pop. (1960) 28,990; (1970) 26,995.

WEBWORM, common name applied to the caterpillar larvae of various widely distributed, lepidopterous moths (see **LEPIDOPTERA**), for their habit of spinning large communal webs. The fall webworm, *Hyphantria cunea*, belongs to the family Arctiidae and reaches a length of $\frac{3}{4}$ in.

This species spins a common web, enclosing several leaves or whole branches of trees; after devouring the leaves or parts of the branches, they move to another tree. The fall webworm is usually dark green in color and is covered with rough, long hairs. The garden webworm, *Loxostege similalis*, belonging to the family Pyralidae, feeds on garden vegetables by drawing the leaves into its web. It is yellow, spotted with black, and averages 1 in. in length. The family Pyralidae also includes the grass webworm, *Crambus caliginosellus*, which spins a web around the stalks and roots of various grasses. It is dark brown above and lighter below, and feeds only at night. During the day, grass webworms retire to a tube of cut grass and silk below the surface of the ground. Methods of protecting crops against webworms include the burning of webs and plowing early in the fall.

See also **CATERPILLAR**; **LARVA**; **MOTH**.

WEDDELL SEA, arm of the South Atlantic Ocean, situated s. of the Falkland Islands, and forming an indentation in Antarctica between Palmer Peninsula and Coats Land. It was discovered by the British navigator James Weddell (1787–1834) in 1823.

WEDDING ANNIVERSARY, annual anniversary of a marriage, associated in more important instances with specific valuable materials or gems. The custom of so naming numerical anniversaries most likely originated from the ancient tradition of giving prescribed gifts for good luck. Although anniversary gifts to married couples now rarely follow the traditional list of substances, terms such as "silver" (twenty-fifth), "golden" (fiftieth), and "diamond" (sixtieth or seventy-fifth), anniversary are still universally used.

See the following list for the most frequently observed anniversaries and their designations:

Anniversary	Gift or Designation
First	Paper or plastics
Second	Cotton
Third	Leather or leatherlike synthetics
Fourth	Silk or silklike synthetics or linen
Fifth	Wood or home decorative accessories
Sixth	Iron
Seventh	Wool, copper, or brass
Eighth	Bronze or electrical appliances
Ninth	Pottery, china, glass or crystal
Tenth	Tin or aluminum
Twentieth	China or occasional furniture
Twenty-fifth	Silver
Fiftieth	Gold

WEDEKIND, Frank (1864–1918), German playwright, born in Hannover, and educated at the universities of Munich and Zürich. He came under the influence of the German playwright Gerhart Hauptmann (q.v.) for a short while in the late 1880's. Later he rejected Hauptmann's

naturalism in favor of the styles developed by the Swedish dramatist August Strindberg (q.v.) and the German poet Georg Büchner (1813–37). Wedekind led a wandering Bohemian life in Munich, Zürich, London, and Paris, working at various jobs. In the 1890's, lack of money forced him to sing his own ballads in cabarets and act on the stage. Finally he joined the staff of the satirical magazine *Simplicissimus*. After his marriage to an actress in 1908, he settled in Munich. Both Wedekind and his wife often took roles in his plays.

Wedekind's first plays, *Die Junge Welt* ("The Young World", 1890) and *Frühlings Erwachen* ("Spring's Awakening", 1891) depict frankly the sexual maturing of adolescents in a world of unsympathetic adults. These works and *Der Erdgeist* ("The Earth Spirit", 1895) established his reputation but were financially unsuccessful. In other plays, notably *Die Büchse der Pandora* ("Pandora's Box", 1904), he portrayed the depraved conduct which arises, in his view, from society's attempt to suppress the sex drive. His works were often censored because of their attacks on middle-class morality; many of them reached a wide audience only after World War I, when German censorship was relaxed.

Wedekind's experiments with unusual themes and stage effects make him an important forerunner of expressionism (q.v.) in Germany. His other works include short stories, essays, and poems.

WEDGWOOD, Josiah (1730–95), British potter, born in Burslem (now part of Stoke-on-Trent), England. At the age of nine, after the death of his father, he left school to work in the ceramic works owned by his family in Burslem. He was apprenticed in 1744 to his older brother, also a potter, and in 1753 he became junior partner in a pottery works at Fenton, Staffordshire. In 1759 he returned to Burslem and set up his own pottery works. There he produced a highly durable cream-colored earthenware that so pleased the British queen Charlotte Sophia (1744–1818), wife of King George III (q.v.), that in 1762 she appointed him royal supplier of dinnerware. From the public sale of the so-called queen's ware, which he patented in 1763, he was able, in 1768, to build near Stoke-on-Trent a village, which he named Etruria, and a second factory equipped with tools and ovens of his own design. At first only ornamental pottery was made in Etruria, but by 1773 Wedgwood had concentrated all his production facilities there.

During his long career Wedgwood raised English pottery making to a fine art. He developed



Wedgwood vase of jasper ware. The classical design by John Flaxman is rendered in a bas-relief of white on a blue background.
Metropolitan Museum of Art

six revolutionary ceramic materials, notably jasper ware and basalt. Wedgwood's basalt, a hard, black, stonelike material known also as Egyptian ware, was used in the manufacture of vases, candlesticks, and realistic busts of historical figures. Jasper ware, his most successful innovation, was a durable unglazed porcelain. The most characteristic types of Wedgwood jasper ware were finely detailed cameos depicting white Grecian figures embossed on a blue background. His fifty jasper-ware reproductions of the Portland Vase, a famous artifact of Roman

WEDNESDAY

antiquity, are considered supreme examples of the potter's art. Many of the finest designs were the work of the British artist John Flaxman (q.v.).

After Wedgwood's death in 1795, his descendants carried on the business. The factory was moved to Barlaston, near Stoke-on-Trent, in 1940. Many of his wares and designs are still in production. Wedgwood was the grandfather of the British naturalist Charles Darwin (see under DARWIN).

See CERAMICS; POTTERY.

WEDNESDAY, fourth day of the week, named to honor Odin (q.v.), or Woden, chief god in Norse mythology. In Sweden and Denmark, the day is *Onsdag*, from its Norse original. The Romans honored their god Mercury by naming the fourth day for him, in Latin, *dies Mercurii*. Countries with languages of Latin origin retain the root: French, *mercredi*; Spanish, *miércoles*; and Italian, *mercoledì*. The Germans call the day *Mittwoch* or midweek. In Hebrew it is the equivalent of fourth day. See also ASH WEDNESDAY.

WEED, Thurlow (1797–1882), American journalist and political leader, born in Greene County, N.Y. As publisher of the influential Albany *Evening Journal* from 1830 to 1863, he wielded great political power nationally, notably in support of the successful Presidential candidacies of William Henry Harrison in 1840 and Zachary Taylor (qq.v.) in 1848. After being elected to the State assembly of New York, he became a leader of the Whig and of the later Republican Party. Weed contributed also to the political advancement of the American statesman William Henry Seward (q.v.), securing the latter's election as governor of New York in 1838 and as United States Senator in 1849. Together with Seward and the American journalist and political leader Horace Greeley (q.v.), Weed effectively dominated New York politics. He supported President Abraham Lincoln (q.v.) and the Union side in the Civil War.

WEEDS, undesirable plants growing wild, usually in cultivated ground. No systematic classification of weeds is possible; a plant may be considered desirable under one set of circumstances, and be a rank pest under another; for example, the white clover is often intentionally cultivated in a lawn, but in a strawberry patch it is out of place. Weeds compete with crop plants for moisture, minerals, and sunlight, thereby reducing the size of the crop. They also may shelter crop diseases and insect pests, and increase the labor required in cultivation.

Methods for the control of weeds depend for their effectiveness on the life history of the par-

ticular species. Annual weeds, such as goosefoot, shepherds' purse, and chickweed, are most easily controlled by cutting off the tops of the plants before their seeds develop; by cultivation, such as hoeing, raking, or forking, early in the season to destroy the young plants; or by pulling up the weeds by hand. Biennial weeds, such as burdock and wild carrot, can be controlled by the same methods as the annual species; perennial weeds, however, especially those which propagate by roots and rootstocks as well as by seed, must have the root destroyed for effective control. Repeated tillage is effective in eradicating perennial weeds, especially when it is combined with the planting of a competitive crop, such as clover alfalfa, soybeans, or cowpeas to crowd out weed plants. Other methods of weed control include mowing; burning; preventing emergence with a mulch of hay, straw, or paper; biological control, involving the use of insects that feed on specific weeds; and the use of chemical herbicides.

Herbicides include nonselective soil sterilizers, with temporary or permanent action. Temporary sterilizers kill all root tissues and then evaporate, leaving the soil ready for cultivation after several weeks. Permanent sterilizers, such as borax, are used for establishing firebreaks. Contact herbicides, which are applied on the top growths, may have a selective action, affecting only weeds and grasses (q.v.). A recently developed herbicide, calcium cyanamide, when applied to the soil, not only destroys weeds but also acts as a fertilizer. After killing the weed, this substance undergoes a chemical change and thereafter supplies lime and nitrogen during the planting season. Thus grass planted after the chemical change has occurred grows in well-fertilized soil, without interference from weeds.

WEEHAWKEN, township of New Jersey, in Hudson Co., on the Hudson R., adjoining Hoboken and immediately N.E. of Jersey City. Transportation facilities include several railroads, and the extensive water front is lined with wharves accommodating the largest ocean-going vessels. Weehawken is an important coal depot, and a manufacturing center, with numerous varied industrial establishments. The township lies along the S. end of the Palisades (q.v.). At a point in Weehawken just below the summit of the Palisades, is the ledge which was the site of the famous duel between the rival statesmen, Alexander Hamilton and Aaron Burr (qq.v.), on July 11, 1804, in which Hamilton was fatally wounded. Weehawken was incorporated in 1859. Pop. (1960) 13,504; (1970) 13,383.

WEEK (fr. Lat. *vicis*, "change"), period of seven days now in universal use as a division of time. It is of Hebrew or Chaldean origin and is mentioned as a unit of time in the Bible (Gen. 29:27). The division of the lunar month into seven-day periods probably began as a celebration of the creation of the world in six days with the seventh day for rest. The Roman week was an eight-day period until 313 A.D., when official recognition of the Christian religion made it necessary to celebrate the Sabbath every seventh day. The modern names for the days of the week, Sunday (Sol), Monday (Moon), Tuesday (Tui, the Saxon Mars), Wednesday (Woden, or Mercury), Thursday (Thor, or Jupiter), Friday (Frygga, or Venus), and Saturday (Saturn), come from Roman or Norse designations for the planets. See CALENDAR.

WEEKS, FEAST OF. See SHABUOTH.

WEEMS, Mason Locke (1759–1825), American preacher and writer, born in Anne Arundel County, Md. After studying for the ministry in England, where in 1784 he was ordained in the Anglican Church, he returned to Maryland to preach. He was an itinerant salesman for the American publisher and bookseller Mathew Carey (1760–1839) after 1792, selling chiefly religious and moralizing tracts, some of which he wrote himself. Parson Weems, as he was popularly called, is remembered chiefly for his fictionalized biography *The Life and Memorable Actions of George Washington* (about 1800); the fifth edition (1806) contains the well-known story, probably apocryphal, of the cherry tree. The public was greatly influenced by his writings and bought them in vast numbers. His other works include *Benjamin Franklin* (1815) and *William Penn* (1822), as well as such moral tracts as *God's Revenge Against Gambling* (1816) and *The Drunkard's Looking Glass* (1818).

WEEVIL, common name for any of numerous coleopterous beetles of the division Rhynchophora, belonging mainly to the families Curculionidae and Scolytidae. The adult weevil is usually dull in color and is herbivorous; it is characterized by a prolongation of the anterior part of the head into a rostrum, or proboscis; the apex of the rostrum contains the biting mouthparts, and two clubbed antennae are attached in depressions at each side. The oval body is covered with a rough, hard integument, and a single median suture traverses the lower part of the head. Weevils exhibit complete metamorphosis; the larvae (see LARVA) are white, semicircular, fleshy grubs with vestigial legs, strong jaws, and rudimentary eyes; they feed entirely on plant life, causing much damage to

crops. The adults usually hibernate during most of the winter.

Classification. The family Curculionidae consists of the true weevils, and contains some 40,000 species native to temperate and subtropical North America and Eurasia. Most weevils of this family are grouped under the subfamily Curculioninae, of which *Curculio* is the characteristic genus. The genus *Curculio*, which contains the nut and acorn weevils, has species characterized by a bulky body and a long, slender beak. In the female, the beak is usually longer than the entire body; it is used for drilling holes in nuts or acorns, and for placing the eggs in the kernels. Squirrels often open acorns in search of the larvae. When the nuts fall to the ground during the autumn, the larvae burrow underground and pupate the following July. The adults average .3 in. from the front margin of the head to the tip of the abdomen. Other weevils of the family Curculionidae include the fruit weevils, which are $\frac{1}{4}$ in. in length, and spend much of the adult and larval stage within various fruits. See also BOLL WEEVIL.

The grain weevils are included in another subdivision, Calendrinae, of the family Curculionidae. The granary weevil, *Sitophilus granarius*, is chestnut brown or black and averages about .13 in. in length. The females produce numerous eggs six times during the year, and deposit them inside the grain kernels. The similar rice weevil, *S. oryza*, is native to India and infests rice and other grains throughout the world. It is a common pantry pest, found frequently in crackers, packaged cereals, or other dried foods. The alfalfa weevil, *Hypera postica*, native to Europe, causes extensive damage to the leaves of the alfalfa crop. Brought to Utah in the early 1900's, it spread later into all the Rocky Mountain States and recently into California and Washington.

The family Scolytidae contains the bark, or engraver, beetles, which create numerous tunnels by burrowing between the bark and wood of trees. The principal genus, *Scolytus*, has a shiny, black thorax, dark-red elytra, and light-brown legs; it averages .12 in. in length. During the breeding season, the female tunnels into the bark or sapwood of various trees, digs several small pockets along the sides of the tunnel, and deposits a single egg in each pocket. Each larva tunnels at right angles to the main burrow, pupating at the end of its burrow. Adults emerging from the pupae bore straight out, producing numerous small wormholes in the bark. Typical species are the fruit-tree bark beetle, *S. rugulosus*; elm-tree fruit beetle, *S. multistriatus*; and hickory-tree beetle, *S. spinosus*.

WEIDENREICH

Various other insects, not included in the division Rhynchophora, are commonly known as weevils. The pea weevil, *Mylabris pisorum*, lays numerous eggs once a year on the pod of young peas, the larvae boring into the seed to pupate. The bean weevil, *M. obtectus*, lays eggs on or within the bean pod, in which the larvae pupate. The flour beetles, notably those in the genus *Tribolium* of the family Tenebrionidae, are commonly found in meal, grain, and vegetables. **Control.** Weevils cause millions of dollars worth of damage every year. Common methods of control consist of burning infested fruits, nuts, or stems; plowing up the ground in which the insects pupate; and spraying crops with insecticides such as DDT (q.v.).

See also BEETLE; ENTOMOLOGY, ECONOMIC.

WEIDENREICH, Franz (1873–1948), German anatomist and physical anthropologist, born in Edenkoben, Germany. He received a medical degree from the University of Strasbourg (1899) and subsequently was professor of anatomy at the universities of Strasbourg (1904–18) and Heidelberg (1921–24), professor of anthropology at the University of Frankfurt (1928–35), and visiting professor at the University of Chicago (1934). At Strasbourg he published many papers on the blood and blood formation, but gradually he became more engrossed in the study of skeletal anatomy, especially of early human remains.

Weidenreich commenced his study, reconstruction, and description of *Sinanthropus pekinensis*, or Peking man (see MAN, ANCIENT), during his years (1935–42) as professor of anatomy at Peking Union Medical College in China. He continued this work during his later association with the American Museum of Natural History in New York City. In 1943 he published a monograph, *The Skull of Sinanthropus pekinensis*, that has gained enduring significance because the *Sinanthropus* fossils had vanished during the Japanese invasion of Peking. His last years were spent in analysis of newly discovered fossil remains, notably *Pithecanthropus erectus*, or Java man, and of Solo man, a Javanese fossil of later origin. Anthropologists consider his *Apes, Giants and Man* (1946), a collection of his lectures, a major contribution to the knowledge of human evolution (q.v.).

WEIFANG, city of the People's Republic of China, in Shantung Province, on the Tsinan-Tsingtao railroad on the Shantung plain, 30 miles N.W. of Tsingtao. In an area growing wheat, peanuts, tobacco, and cotton, it is a center for agricultural trade and for the coal mines at Fangtze (Fang-tzu), 8 miles S.E. of the adminis-

trative center of the municipality. Cotton and silk weaving, tobacco processing, flour milling, and the manufacture of handicrafts (embroideries and silver and wood carvings) and matches are the chief industries in the city, which was opened to foreign trade in 1906. It was called Weihsien until 1949; the name is also spelled Wei-fang. Pop. (1970 est.) 260,000.

WEIGHING, determination of the gravitational force exerted on an object; see GRAVITATION. The purpose of weighing is generally to determine the mass (amount of matter) of the object by using either a comparative method, as with a chemical-laboratory balance, or by measuring the gravitational force directly by means of a spring scale, such as the familiar bathroom scale; see MASS; SPRING. The deflection of a spring scale is proportional to the mass, but depends also on the local gravitational attraction, and therefore, a spring scale would record different weights for the same mass at locations with a different gravitational attraction. This problem is avoided by using the so-called beam scale such as that employed in the chemical-laboratory balance. In this, two pans are suspended from a cross beam which rests on a fulcrum, and a pointer is used to indicate balance when equal masses are in both pans. Because both masses are subject to the same gravitational attraction, weighing is performed by comparison and is independent of the specific magnitude of the local gravitational attraction.

A chemical-laboratory balance uses equal arms and therefore requires weights that are at least as heavy as the heaviest object to be weighed. For heavy loads, this can be avoided, by unequal lever-arm arrangements and correspondingly smaller weights. Specially designed multiple unequal-arm arrangements are utilized in heavy-duty platform scales and in so-called weigh bridges for trucks and railroad cars. In these, weighing is usually achieved by using fixed weights and also by sliding a weight along a beam until balance is reached. An alternative technique employed primarily in small commercial scales, is the use of a fixed-pendulum counterweight that swings outward from the vertical as the load is increased, and moves a pointer on a dial to a precalibrated indicating position. The simplest example of such a pendulum-type scale is the pocket letter balance.

See also WEIGHTS AND MEASURES.

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WEIGHT CONTROL, means of regulating weight through diet and exercise. See OBESITY. **WEIGHTLESSNESS.** See SPACE MEDICINE.

WEIGHT LIFTING, athletic sport based on the lifting of a series of progressively heavier metal

weights. Participants engage in the sport competitively, for recreational purposes, or as a form of muscle building. As a competitive sport weight lifting is popular internationally, notably in the United States, the Soviet Union, East Germany, West Germany, Rumania, Poland, Finland, and Cuba. The sport is highly organized with 109 nations being affiliated with the International Weightlifting Federation. In the U.S. it is contested under rules established by the Amateur Athletic Union; it is also on the program of the Olympic Games (q.v.).

Equipment. The chief item of equipment used in weight lifting is the barbell, a steel rod to which plates or disks of different weights, usually made of iron, may be attached interchangeably by means of clamps.

Types of Lifts. Participants in weight-lifting contests are tested usually in three types of lifts, namely the press, the snatch, and the clean-and-jerk. The press has two distinct phases. In the first phase the contestant grasps the rod, or handle, of the barbell and raises it to the level of his shoulders; in the second phase, with minimum back bend, he raises the barbell overhead, extending his arms fully. The lifter must keep his feet on the same plane throughout the lift and during the second phase he must hold both legs perfectly straight.

In executing the snatch the contestant grasps the barbell and in one continuous motion lifts it to a position of arms' length overhead; both legs may be flexed or moved at any time during this lift, but must be returned to the same plane.

The clean-and-jerk involves lifting the barbell to the shoulder level in one motion and above the head in another, separate motion. It differs from the press in that the legs may be flexed or the feet may be moved to facilitate the lift; most competitors gain power for the final, upward thrust by bending and then suddenly straightening the knees, then lowering the body under the barbell.

Competition. Weight lifters compete in nine classes, which are based on body weight. These classes, together with the maximum body weight in pounds allowed in each class, are flyweight (114½), bantamweight (123½), featherweight (132¼), lightweight (148¾), middleweight (165¼), light-heavyweight (181¾), middle-heavyweight (198¼), heavyweight (242½), and super-heavyweight (over 242½).

In Olympic and other championship competition, contestants often lift from 90 to 150 lb. more than their body weight in the press and the snatch, and from 180 to 220 lb. more than their body weight in the clean-and-jerk. The

contestant lifting the greatest aggregate weight in the three events wins the competition. In 1970 the world's records for super-heavyweights were 481½ lb. for the press, 388 lb. for the snatch, 501½ lb. for the clean-and-jerk, and 1339¼ lb. for the total of all three lifts. In 1970 the press was eliminated in world and Olympic events. Contests comprising one-handed as well as two-handed lifts were recognized in international competition until 1956. Power-lifting competition, consisting of the bench press, squat, and dead lift, was introduced in the U.S. in 1965, but is not recognized internationally.

WEIGHTS AND MEASURES, measurements of length, capacity, and weight, using standard units. The principal early standards of length were the palm or hand breadth, the foot, and the cubit, which is the length from elbow to tip of middle finger. Such standards were both changeable and perishable, and only within modern times have definite unchanging standards of measurement been adopted.

In the United States and Great Britain, the everyday units of linear measurement have been the inch, foot, yard, and mile. Until recently, in Great Britain the English units of length were defined in terms of the imperial standard yard, which was the distance between two lines on a bronze bar made in 1845 to replace an earlier yard bar which had been destroyed by fire in 1839. Because the imperial standard yard bar has been shrinking at the rate of 1.5 millionths of an inch per year, the U.S. adopted a copy of the international prototype meter as the national standard of length in 1889. From that time until 1960, all U.S. measurements of length were derived from a standard meter (meter prototype number 27). In 1960, the meter was redefined in terms of wavelengths of light. Today, most linear measurements are based on this standard.

English units of weight (ounces, pounds, and tons) are now also derived from the metric standard of mass, which is the international prototype kilogram. This is a solid cylinder of platinum-iridium alloy maintained at constant temperature at Sèvres near Paris. A copy, as exact as possible, of this standard kilogram is maintained by the National Bureau of Standards (q.v.) in Washington, D.C., and all units of weight in the U.S. are derived from it.

Most countries have converted or are in the process of converting their local systems of weights and measures to the metric system. See tables on following pages. Some old terms, however, may continue in use in remote areas. See also DECIMAL SYSTEM; INTERNATIONAL SYSTEM OF UNITS; METRIC SYSTEM.

WEIGHTS AND MEASURES

ENGLISH SYSTEM OF WEIGHTS AND MEASURES

Linear Measure (Length)

1000 mils	= 1 inch (in)
12 inches	= 1 foot (ft)
3 feet	= 1 yard (yd)
5½ yards	= 1 rod (rd)
40 rods	= 1 furlong (fur)
8 furlongs	= 1 mile (mi)
5280 feet	= 1 mile
3 miles	= 1 league (l.)

Square Measure (Area)

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
30¼ square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre
640 acres	= 1 square mile (sq. mi.)

Cubic Measure (Volume)

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cubic feet	= 1 cubic yard (cu. yd.)
231 cubic inches	= 1 U.S. gallon (gal.)
277.27 cubic inches	= 1 British imperial gallon (l.gal.)
2150.42 cubic inches	= 1 U.S. bushel (bu.)
2219.36 cubic inches	= 1 British imperial bushel (i bu.)

Liquid Measure (Capacity)

4 fluid ounces (fl. oz.)	= 1 gill (gi.)
4 gills	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts	= 1 gallon

Dry Measure (Capacity)

2 pints	= 1 quart
8 quarts	= 1 peck (pk.)
4 pecks	= 1 bushel

Weight (Avoirdupois)

27 3438 grains	= 1 dram (dr.)
16 drams	= 1 ounce (oz.)
16 ounces	= 1 pound (lb.)
14 pounds	= 1 stone
100 pounds	= 1 hundredweight (cwt.)
8 stones	= 1 long hundredweight (l.cwt.)
2000 pounds	= 1 short ton (S.T.)
2240 pounds	= 1 long ton (L.T.), or 20 l.cwt.

Weight (Troy)

24 grains	= 1 pennyweight (dwt.)
20 pennyweights	= 1 ounce (oz.t.)
12 ounces	= 1 pound (lb t.)

Weight (Apothecaries')

20 grains	= 1 scruple (s.ap.)
3 scruples	= 1 dram (dr.ap.)
8 drams	= 1 ounce (oz.ap.)
12 ounces	= 1 pound (lb.ap.)

Surveyors' Measure

7.92 inches	= 1 link (li.)
100 links	= 1 chain (ch.)
66 feet	= 1 chain
80 chains	= 1 mile

Mariners' Measure

6 feet	= 1 fathom (fath.)
120 fathoms	= 1 cable's length (U.S. Navy)
1852 meters	= 1 nautical mile
1 nautical mile per hour	= 1 knot (k)

Wood Measure

144 cubic inches (1' x 1' x 1")	= 1 board foot (f.b.m.)
16 cubic feet (4' x 4' x 1")	= 1 cord foot (cd.ft.)
8 cord feet	= 1 cord (cd.)

Paper Measure

25 sheets	= 1 quire (qr.)
20 quires	= 1 standard ream (rm.)
516 sheets	= 1 printers' ream
2 reams	= 1 bundle (bdl.)
4 bundles	= 1 case (c.)

Printers' Measure (Typography)

0.013837 inches	= 1 point
12 points	= 1 pica

Angular or Circular Measure

60 seconds	= 1 minute (min.)
60 minutes	= 1 degree
30 degrees	= 1 zodiac sign
57.2958 degrees	= 1 radian
90 degrees	= 1 quadrant or right angle
360 degrees	= 1 circle

METRIC SYSTEM OF WEIGHTS AND MEASURES

Linear Measure (Length)

1/10 meter (m)	= 1 decimeter (dm)
1/10 decimeter	= 1 centimeter (cm)
1/10 centimeter	= 1 millimeter (mm)
1/1000 millimeter	= 1 micrometer (µm) (formerly micron)
1/1000 micron	= 1 nanometer (nm)
100 meters	= 1 hectometer (hm)
10 hectometers	= 1 kilometer (km)
1000 kilometers	= 1 megameter

Square Measure (Area)

1 are	= 1 square dekameter (dam²)
1 hectare	= 1 square hectometer (hm²)

Cubic Measure (Volume or Capacity)

1/10 liter	= 1 deciliter (dl)
1/1000 liter	= 1 milliliter (ml)
1000 liters	= 1 cubic meter (m³)

Weight

1/1000 gram	= 1 milligram (mg)
1/1000 milligram	= 1 microgram (µg)
1000 grams	= 1 kilogram (kg)
1000 kilograms	= 1 metric ton (megagram, tonne) (t)

CONVERSION BETWEEN ENGLISH AND METRIC UNITS

Approximate Common Equivalents

Units of Length

1 inch = 25 millimeters
1 foot = 0.3 meter
1 yard = 0.9 meter
1 mile = 1.6 kilometers

Units of Area

1 square inch = 6.5 square centimeters
1 square foot = 0.09 square meter
1 square yard = 0.8 square meter
1 acre = 0.4 hectare

Units of Volume

1 cubic inch = 16 cubic centimeters
1 cubic foot = 0.03 cubic meter
1 cubic yard = 0.8 cubic meter

Capacity (liquid)

1 quart = 1 liter
1 gallon = 0.004 cubic meter

Units of Mass

1 ounce (avoirdupois) = 28 grams
1 pound (avoirdupois) = 0.45 kilogram

CONVERSION BETWEEN METRIC AND ENGLISH UNITS

Approximate Common Equivalents

Units of Length

1 millimeter = 0.04 inch
1 meter = 3.3 feet
1 meter = 1.1 yards
1 kilometer = 0.6 mile

Units of Area

1 square centimeter = 0.16 square inch
1 square meter = 11 square feet
1 square meter = 1.2 square yards
1 hectare = 2.5 acres

Units of Volume

1 cubic centimeter = 0.06 cubic inch
1 cubic meter = 35 cubic feet
1 cubic meter = 1.3 cubic yards

Capacity (liquid)

1 liter = 1 quart
1 cubic meter = 250 gallons

Units of Mass

1 gram = 0.035 ounce
1 kilogram = 2.2 pounds

MISCELLANEOUS UNITS OF WEIGHTS AND MEASURES

Absolute zero = -273.16°C , or -459.69°F

1 angstrom unit = 0.1 micrometer
1 atmosphere = 760 mm of mercury
1 bolt of cloth = 40 yards
1 cup = 8 fluid ounces
1 gross = 12 dozen, or 144
1 carat (international) = 200 milligrams (gem weight)
1 light-year = 5.88×10^{12} miles
1 megaton = 1 000 000 tons
1 tablespoon = $\frac{1}{2}$ fluid ounce
3 teaspoons = 1 tablespoon

FOREIGN WEIGHTS AND MEASURES FORMERLY IN COMMON USE

Weights or Measures	Where Used	American Equivalents
Almude	Portugal	4.423 gal
Ardeb	A.R.E.	5 6189 bu.
Arroba	Argentina	25.32 lb
Arroba	Brazil	32.38 lb
Arroba	Cuba	25.36 lb.
Arroba	Paraguay	25.32 lb
Arroba	Venezuela	25 40 lb
Arroba (liquid)	Cuba; Spain, Venezuela	4.263 gal
Arshin	U.S.S.R.	28 in
Artel	Morocco	1 12 lb.
Baril	Argentina	20.077 gal.
Baril	Mexico	20.0787 gal.
Berkovets	U S S.R.	361 128 lb
Caballeria	Cuba33 162 acres
Carat (metric)	World	3.086 grains
Catty	China	1.333 lb.
Catty	Indonesia	1.36 lb.
Centaro	Central America	4.2631 gal
Centner	Denmark, Norway	110 23 lb.
Centner	Sweden	93 7 lb
Chetvert	U S S R	5 957 bu.
Ch'in	China	12.60 in.
Chô	Japan	357 90 ft.
Chô (land measure)	Japan	2.4506 acres
Cuadra	Argentina	4.2 acres
Cuadra	Paraguay	1.85 acres
Cuadra	Uruguay	1 82 acres
Dessiatine	U.S.S.R.	2.6997 acres
Drachma	Greece	49.38 grains
Dunam	Israel	0 22239 acre
Fanega (dry)	Ecuador; Salvador	1 5745 bu.
Fanega	Chile	2 75268 bu.
Fanega (dry)	Guatemala; Spain	1.57744 bu.
Fanega	Mexico	2 57716 bu
Fanega (liquid)	Spain	16 gal.
Fanega	Uruguay	3.888 bu.
Fanega	Venezuela	3.334 bu.
Feddán	A.R.E.	1 038 acres
Frall (raisins)	Spain	50 lb.
Frasco	Argentina	2.51 liquid qts
Funt	U S.S.R	0 9028 lb.
Garniec	Poland	1.0567 gal
Jerib	Iran	2.471 acres
Joch	Austria	1 422 acres
Joch	Hungary	1.067 acres
Kantar	A.R.E.99.05 lb.
Kantar	Morocco112 lb
Kantar	Turkey	124 45 lb.
Ken	Japan	5.965 ft.
Kin	Japan	1 323 lb.
Koku	Japan	5 119 bu.
Kwan	Japan	8.267 lb.
Li	China	1890 ft.
Li	China	0.0126 in.
Libra	Argentina	1.0128 lb
Libra	Central America, Chile; Spain	1.014 lb
Libra	Cuba, Peru, Venezuela	1.0143 lb.
Libra	Mexico	1.01467 lb.
Libra	Uruguay	1.0127 lb.
Manzana	Nicaragua	1.742 acres
Manzana	Costa Rica	1.727 acres
Marco	Bolivia	0.507 lb.
Mil	Denmark	4.68 m.
Milla	Nicaragua	1.1594 m.
Milla	Honduras	1.1493 m.
Mina	Greece	0.95 lb
Oka or Oke	Greece	2.82 lb
Oke	A.R.E.	2.7514 lb.
Oke	Turkey	2 826 lb.
Pic	A R.E.	22 83 in.
Picul	China	133.33 lb.
Picul	Indonesia	136.16 lb.
Picul	Philippines	139.44 lb.
Pik	Turkey	27.9 in.

Continued on page 34

Foreign Weights and Measures—Continued from page 33

Weights or Measures	Where Used	American Equivalents
Pood	U.S.S.R.	36.113 lb.
Pund	Denmark	1.102 lb.
Quintal	Argentina	101.3 lb.
Quintal	Brazil	129.54 lb.
Quintal	Chile	101.43 lb.
Quintal	Mexico	101.47 lb.
Quintal	Spain	220.4 lb.
Rotl	Israel	6.35 lb.
Sagene	U.S.S.R.	7 ft.
Shaku	Japan	11.9303 in.
Skaipund	Sweden	0.937 lb.
Sun	Japan	1.193 in.
To	Japan	2.05 pecks
Tonde (cereal)	Denmark	3.948 bu.
Tonde (land)	Denmark	1.36 acres
Tsubo	Japan	35.58 sq.ft.
Ts'un	China	1.26 in.
Tunna (wheat)	Sweden	4.16 bu.
Tunnland	Sweden	1.22 acres
Vara	Argentina	34.0944 in.
Vara	Guatemala	32.909 in.
Vara	Honduras	32.874 in.
Vara	Nicaragua	33.057 in.
Vara	Chile, Costa Rica	
Vara	Peru	32.913 in.
Vara	Cuba	33.386 in.
Vara	Mexico	32.992 in.
Vedro	U.S.S.R.	3.249 gal.
Verst	U.S.S.R.	0.663 mi.
Vioka	Poland	41.50 acres

WEIHAI, formerly WEIHAIWEI, city and port of the People's Republic of China, in Shantung Province, on the N.E. coast of Shantung Peninsula at the entrance to the Gulf of Chihli, about 40 miles E. of Chefoo. The city has an excellent natural harbor, sheltered by Liukung Island, and is an important shipping center. Possessing a mild climate, it is noted also as a summer resort. In 1895, during the Sino-Japanese War, the city was captured by the Japanese, who occupied it until 1898. In that year, together with the surrounding territory and waters covering a total area of 285 sq.mi., it was leased to Great Britain. The British returned the port to China in 1930. After the outbreak of hostilities between China and Japan in 1938, it was again occupied by the Japanese. The city was restored to China in 1945 at the end of World War II. It received its present name in 1949. Pop. (1970 est.) 30,000.

WEILL, Kurt (1900-50), German-American composer, born in Dessau. He studied composition in Berlin with the Italian composer Ferruccio Busoni and the German composer Engelbert Humperdinck (qq.v.). Two short imaginative operas brought Weill some early acclaim, *Der Protagonist* ("The Protagonist", 1926) and *Der Zar Lässt Sich Photographieren* ("The Czar Lets Himself Be Photographed", 1928). His first great success, however, was *Die Dreigroschenoper* (1928; Eng. production, *The Threepenny Opera*, 1954), written in collaboration with the German playwright Bertolt Brecht (q.v.); see **DRAMA**: *National Drama: Germany*. An adaptation of *The Beggar's Opera* (1728) by the British

poet and dramatist John Gay (q.v.), *Die Dreigroschenoper* was one of two collaborations between Weill and Brecht to win international acclaim and create a new form of musical theater. The other was *Aufstieg und Fall der Stadt Mahagonny* (1929; Eng. production, *Mahagonny*, 1970). Satiric and didactic, both works used music to underscore the meaning and mood of spoken dialogue and contemporary music techniques, including jazz and the tango. These elements and the themes of the plays combine to achieve a bitter but brilliant atmosphere of corruption.

Weill left Germany in 1933 when his productions were banned by the government because of antitotalitarian overtones. He then lived in Paris, where he composed the ballet *The Seven Deadly Sins* (1933). Moving to the United States in 1935, he became an American citizen eight years later. In America he composed for the musical theater. His successful Broadway productions include *Knickerbocker Holiday* (1938), a collaboration with the American playwright Maxwell Anderson (q.v.); *Lady in the Dark* (1941), with the playwright Moss Hart (q.v.) and the lyricist Ira Gershwin (1896-); and *One Touch of Venus* (1943), with the poet Ogden Nash (q.v.) and the humorist S. J. Perelman (1904-79). Later works by Weill were more serious in tone. These include *Street Scene* (1947), from a drama by the playwright Elmer Rice (q.v.), and *Lost in the Stars* (1949), adapted by Maxwell Anderson from the novel *Cry, the Beloved Country* (1948) by the South African author Alan Paton (q.v.).

Weill, in such songs as "Mack the Knife" from *Die Dreigroschenoper* and "September Song" from *Knickerbocker Holiday*, was able both to appeal to mass audiences and to achieve a high standard of musical excellence. In 1928 Weill married the German-American actress and singer Lotte Lenya (1905-), who performed in many of his works.

WEIMAR, city of East Germany, in Erfurt District, on the Ilm R., about 65 miles S.W. of Leipzig. It is a railroad junction, and there are factories engaged in the manufacture of textiles, paper, machinery, motor cars, musical instruments, electrical equipment, glass, and shoes. Weimar has a medieval quality, with its many narrow streets and old, gabled houses, and is the site of numerous architectural landmarks.

During most of the 18th century and the first decade of the 19th the city was the foremost cultural center of Germany and the residence of such outstanding literary figures as Johann Wolfgang von Goethe, Johann Gottfried von

Herder, Johann Christoph Friedrich von Schiller, and Christoph Martin Wieland (qq.v.). Noteworthy architectural landmarks include the parish church, dating from the 15th century, largely reconstructed in the 18th century, and containing an altar piece executed by the German painter and etcher Lucas Cranach (q.v.), the elder; the Red and Green castles, dating from the 16th and 18th centuries, respectively; the former grand ducal palace, which was built (1789–1803) under Goethe's direction; Goethe's home, now a museum, and his summer cottage, at the edge of a beautiful park; Schiller's humble residence; and the state theater (replaced in 1907 by a new building), where the Hungarian pianist and composer Franz Liszt (q.v.) was musical director (1848–59) and where many of the operas by the German composer Richard Wagner (q.v.) were first performed. Among the city's cultural treasures are the Goethe-Schiller archives and the archives of the German philosopher and poet Friedrich Wilhelm Nietzsche (q.v.). Weimar is the site of numerous educational institutions.

Weimar was founded probably in the 9th century. After varying periods under the control of successive counts and landgraves, it became (1485) a possession of the Ernestine branch of the house of Wettin. In 1547 the city was made the capital of the duchy of Saxe-Weimar. In 1919, following World War I, the German National Assembly, meeting in Weimar, established the German Republic, known also as the "Weimar Republic", and drafted a democratic constitution. Weimar became the capital of the newly created State of Thuringia in 1920. In World War II the National Socialist government of Germany operated a notorious concentration camp (q.v.) in nearby Buchenwald. American troops entered Weimar in April, 1945. Pop. (1972 est.) 63,361.

WEIMARANER, breed of hunting dog that originated in Weimar, Germany, at the beginning of the 19th century, and which is believed to have been derived chiefly from a variety of bloodhound (q.v.). The dog was bred by members of a club known as the Weimaraner Club, which strictly limited its membership and imposed breeding standards so rigid that the number of Weimaraner dogs in Germany has never exceeded 1500. The breed was imported into the United States in 1929 by an American who had become a member of the club, and the dog has steadily become more popular in this country. The dog runs with great speed, having been known to exceed 38 m.p.h.; thus, with the whip-pet, it is one of the fastest of domesticated ani-

mals. Originally the Weimaraner was used for hunting large game, such as wolves, deer, and wild boars, and later for hunting birds. The dog is often kept as a watchdog or a pet. The animal has an aristocratic-looking head; slightly folded ears which are placed fairly high; intelligent eyes that are blue-gray or amber in color; straight, muscular forelegs and powerful hind-legs; and a tail that is cropped when the puppy is about three days old and which grows to a maximum length of about six in. It has a short coat which may be any one of various shades of gray. The male is from 24 to 27 in. high at the withers and weighs between 65 and 85 lb.; the female is from 22 to 25 in. high and weighs between 55 and 75 lb.

WEINBERG, Alvin Martin (1915–), American physicist, born in Chicago, Ill. He attended the University of Chicago, from which he received a Ph.D. degree in 1939. In 1942 he began research in nuclear energy at the University of Chicago Metallurgical Laboratory. He joined the staff of the Oak Ridge (Tenn.) National Laboratory in 1945 and ten years later was made its director. Weinberg was one of a team of theoretical physicists, headed by Eugene Paul Wigner (q.v.), that during World War II designed the first large nuclear-power reactor. He was also instrumental in developing the pressurized water reactor system, which is the basis for all nuclear reactors used for propelling ships and generating electric power. In 1960 Weinberg was co-recipient of the Atoms for Peace Award established by the Ford Motor Company Fund and also shared the Ernest Orlando Lawrence Memorial Award with four other scientists. He is the author of *Reflections on Big Science* (1967) and *The Physical Theory of Neutron Chain Reactors* (with Wigner, 1958).

WEIRTON, city of West Virginia, in Hancock and Brooke counties, on the Ohio R., 25 miles N. of Wheeling, in the Steubenville (Ohio)-Weirton metropolitan area. Once called both the "largest company town" and the "largest unincorporated town" in America, it is a major steel-producing center in the N. panhandle of the State and has a large foreign-born population. The city includes Weirton, Weirton Heights, Marland Heights, and Hollidays Cove, the last-named a residential community settled in 1776 and connected by bridge with Ohio. Coal, clay, sand, and gravel are mined in the area, and the large iron and steel complex in the city includes tin-plating and zinc-coating plants and factories manufacturing chemicals, cement and concrete, asphalt, tools, metal products, and household equipment. The first blast furnace west of the

WEISGARD

Alleghenies was built here on Kings Creek in 1794 and in 1813 supplied cannonballs to the Lake Erie fleet. Becoming a company town, the community grew quickly after 1910 and was incorporated in 1947. Pop. (1960) 28,201; (1970) 27,131.

WEISGARD, Leonard. See CHILDREN'S LITERATURE: *The Period after World War I.*

WEISMANN, August (1834–1914), German biologist, born in Frankfurt-am-Main, and educated at the universities of Göttingen and Geissen. He practiced medicine until 1863, when he turned to biological research and the study of zoology. From 1886 to 1912 he was professor of zoology at the University of Freiburg. He achieved distinction through his zoological investigations, notably on the embryology of insects and crustaceans. Weismann is best known as the originator of the germ-plasm theory of heredity (q.v.), the concept that a special hereditary substance, germ plasm, constitutes the only organic continuity between one generation and the next. He was the first scientist to reject as unproven the doctrine of the French naturalist, the Chevalier de Lamarck (q.v.), that characteristics acquired during the lifetime of an individual may be transmitted to the off-

spring; see LAMARCKISM. Weismann, in turn, determined that the hereditary substance of the germ cells is completely independent of changes in the external environment. According to Weismann's theory of germinal selection, variations are caused by germ-plasm differences among individual members of the same species and by the natural selection of these differences through breeding. His writings include *Das Keimplasma* (1892; Eng. trans., *Germ Plasm*, 1893).

WEISSMULLER, John (Johnny) (1904–), American swimmer and motion picture actor, born in Windber, Pa. The foremost freestyle swimmer in the world during the 1920's, he held during that decade every world record from distances of 100 yd. to a half mile. In competition at the Olympic Games in 1924 and 1928 he won gold medals in the 100-meter and 400-meter freestyle events. Between 1922 and 1927 he five times broke or bettered the world record for the 100-yd. freestyle. In 1932 Weissmuller embarked on a motion picture career and soon became identified with the role of Tarzan, the jungle hero created by the American adventure writer Edgar Rice Burroughs (q.v.).

WEIZMANN, Chaim (1874–1952), Israeli statesman and chemist, born in Motol', Russia (now in the White Russian S.S.R.), and educated

Chaim Weizmann takes the oath of office as the first president of Israel on Feb. 17, 1949.
UPI



at the universities of Berlin in Germany and Fribourg in Switzerland. He was appointed lecturer in chemistry at the University of Geneva in 1901 and reader in biochemistry at the University of Manchester in 1904. Weizmann became a British subject in 1910. From 1916 to 1919 he was director of the World War I British admiralty laboratories; in this capacity he was responsible for the discovery and development of a method for synthesizing acetone, a substance used in the manufacture of explosives.

When still a student Weizmann had become interested in Zionism (q.v.), and he was an early leader of the movement. During World War I he was instrumental in securing proclamation by the British government of the Balfour Declaration (q.v.), endorsing the establishment of a Jewish national home in Palestine. From 1921 to 1929 Weizmann was president of the World Zionist Organization, acting as a force for compromise between the Zionists who wanted immediate enactment of the Balfour Declaration and the British and Arabs who resisted all attempts to realize the declaration. From 1929 to 1931 and from 1935 to 1946 he held the office of president of the Jewish Agency for Palestine, a quasi-governmental organization under the British mandatory authorities; he thus exercised some political authority over Jewish residents of Palestine.

Himself a resident of Palestine from 1934, Weizmann served also as director of the Daniel Sieff Research Institute at Rehovot and as president of the board of governors of the Hebrew University (q.v.) of Jerusalem. From 1939 to 1945, during World War II, he was honorary adviser to the British ministry of supply. In 1948 Weizmann was named president of the provisional government and the following year he became the first president of the new nation of Israel (q.v.).

The Weizmann Institute of Science, incorporating the Sieff Institute, was founded at Rehovot in 1949 and Weizmann was appointed director. His scientific research in Palestine and Israel was largely in the field of agronomy, concerned with crop production and soil management and the development of new protein foodstuffs. His autobiography, *Trial and Error*, was published in 1949.

WELDING, in engineering, any of about forty processes in which two or more pieces of metal are joined together by the application of heat, pressure, or a combination of both. Most of the processes may be grouped into two main categories, the pressure-welding processes, in which the weld is achieved by pressure, and the non-pressure-welding processes, in which the

weld is achieved by heat alone. Brazing (q.v.) and soldering (see **SOLDER**) are other methods of joining metals.

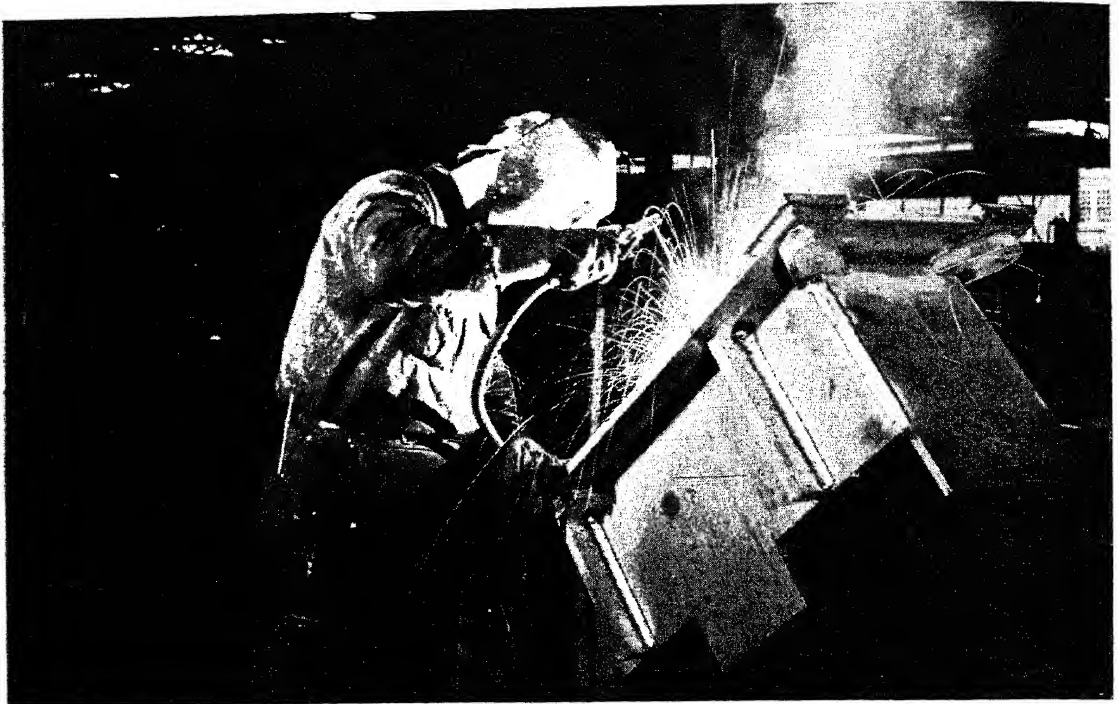
The welding process used to join two pieces of metal depends on the physical properties of the materials to be joined, the specific use to which they are applied, and the production facilities available. With the development of new techniques, welding has supplanted bolting and riveting in the construction of many types of structures, including bridges, buildings, and ships. It is also a basic process in the automotive and aircraft industries, and in the manufacture of machinery.

Welding processes are generally classified according to the sources of heat and pressure used. The processes most commonly employed include gas welding, arc welding, and resistance welding. Among other processes are forge welding and Thermit welding.

Forge Welding. The original pressure process, forge welding, was practiced for centuries by blacksmiths and other artisans. The metal is brought to a suitable temperature in a furnace, and the weld is consummated by hammering or other mechanical pressure. Adaptable only to comparatively heavy-metal sections, forge welding is used rarely in modern manufacturing.

Gas Welding. Gas welding is a nonpressure process utilizing heat from a gas flame. In many applications the flame is obtained from the combustion of oxygen and acetylene (qq.v.). The oxyacetylene torch is applied directly to the metal edges to be joined and simultaneously to a filler metal in wire or rod form, called the welding rod, which is melted into the joint. Gas welding has the advantage of using apparatus that is readily portable and independent of an electric-power source. The surfaces to be welded and the welding rod are coated with a fusible material called flux, which prevents formation of oxides or nitrides that would result in a defective weld.

Arc Welding. Arc-welding processes, which are the most important welding processes, particularly for joining steels, require a continuous supply of either direct or alternating electrical current; see **ELECTRIC ARC**. These processes have several advantages over other welding methods in certain applications. The welding speed is faster because of high heat concentration, which also tends to reduce distortion. Also, in certain methods of arc welding, fluxes may be eliminated. Four different processes of arc welding are commonly used. Metal-arc, carbon-arc, and atomic-hydrogen-arc welding have been in use for some time. The fourth and new-



A machine base for steel-mill rolling equipment is arc welded by a skilled worker.

General Electric Co.

est process, inert-gas-arc welding, was developed after World War II.

METAL ARC. In metal-arc welding the arc is formed from a metallic electrode (q.v.) to the metal. The intense heat produced by the electric current across the gap melts both the parts to be welded and the point of the metallic electrode, which supplies the filler metal for the weld. To prevent the formation of oxides and nitrides, the electrode is coated frequently with a substance that, when heated, melts to form a flux or a gaseous envelope to shield the work.

CARBON ARC. The carbon-arc process utilizes a carbon electrode instead of a metallic one. A flux-coated rod is often used as a filler metal; it is fed into the arc flame in the same manner as in gas welding.

ATOMIC- HYDROGEN ARC. In atomic-hydrogen-arc welding, the source of heat is a stream of hydrogen passing through an arc between two tungsten electrodes. The hydrogen gas, which is normally in the form of molecules containing two atoms, is dissociated into single atoms by the heat of the arc. At or near the work surfaces, the atoms recombine, releasing enormous quantities of heat.

INERT-GAS ARC. In inert-gas-arc welding, the arc is formed between a tungsten electrode and the metal. An inert gas, such as helium or argon, is

used as a shield; the latter eliminates the need for fluxes. First applied in the welding of magnesium, with helium as the shielding gas, the process was known originally as heliarc welding. It is widely used in the fabrication of stainless-steel and aluminum-alloy products.

Resistance Welding. The characteristic of this group of pressure processes is that heat is obtained from the resistance of metal to the flow of an electric current. In resistance welding, electrodes are clamped on either side of the parts to be welded, the parts are subjected to great pressure, and a heavy current is applied briefly. Fusion results from the combined effect of heavy pressure and high heat. Resistance welding is extensively employed in many fields of manufacturing and is particularly adaptable to repetitive welds made by automatic or semi-automatic machines.

Thermit Welding. In this form of welding, heat is generated by the chemical reaction which results when a mixture of aluminum powder and iron oxide, known as Thermit, is ignited. The aluminum unites with the oxygen at high temperatures, and the iron is released in the form of liquid steel, which serves as filler metal for the weld. Thermit welding is employed chiefly in welding breaks or seams in heavy iron and steel sections. It is used also in the welding of railroad tracks.

New Processes. Two more recently developed pressure-welding processes are coming into in-

creasing use. In one method, sufficient pressure is applied to cause ductile metals to flow at room temperature. This technique is called the cold-pressure process. Another method involves the use of ultrasonic waves to achieve the weld; see **ULTRASONICS**. Other new methods of fusion welding not in common use include those using electron beams, lasers, and plasma arcs as powerful sources of heat; see **ELECTRON**; **LASER**; **PHYSICS**: *Developments in Physics since 1930*: *Plasma Physics*. C.F.F.

WELFARE ADMINISTRATION. See **SOCIAL AND REHABILITATION SERVICE**.

WELFARE AND PENSION PLANS, in the United States, plans maintained by employers separately, or by employers and employees jointly, to provide life insurance, accident-and-health insurance, or pension benefits for employees. Such plans sometimes are called private, or voluntary, employee-benefit plans to distinguish them from the types of social insurance required by law or administered by government, for example, social security and workmen's compensation (qq.v.).

Welfare and pension plans received their greatest impetus during and immediately following World War II. Among the factors responsible for this development were the wartime freeze on wage increases as such, while so-called fringe benefits were permitted; the tax-exempt status of employer contributions to pension funds; and a ruling by the National Labor Relations Board that welfare benefits were a proper subject for collective bargaining between employers and employees. In the early 1970's it was estimated that employer and employee contributions to welfare and pension plans were \$27,878,000,000 annually; annual benefits paid to workers totaled \$20,683,000,000.

Benefits. The plans vary in types and amounts of benefits provided, because benefits are determined largely by collective bargaining in individual plants, localities, or industries, or, in the case of unilateral employer plans, by the ability of the employer to contribute. Almost all plans provide hospital benefits. In the early 1970's, 153,000,000 workers and workers' dependents were provided with some type of hospitalization insurance under these plans; 69 percent of all employed civilian workers were included in this group. Other benefits provided in the same period were surgical protection and medical-care protection for 151,000,000 and 133,000,000 workers and dependents, respectively. In addition, 60,000,000 workers were covered by life insurance, 31,000,000 by temporary disability insurance, and 39,000,000 by acciden-

tal-death and -dismemberment insurance; see **HEALTH INSURANCE**. About 29,700,000 employees, or almost 48 percent of the employed civilian labor force, were covered for retirement benefits. The reserves set aside to pay retirement allowances when due totaled \$137,100,000,000 at the beginning of 1972.

It is evident from the magnitude of these figures that welfare and pension programs account for a significant share of the American wage earner's insurance protection and represent an important supplement to such public programs as old-age and survivor's insurance and Medicare under the social-security system, unemployment-compensation insurance, and workmen's compensation; see **MEDICARE AND MEDICAID**; **UNEMPLOYMENT INSURANCE**.

Welfare and pension plans vary widely in financing, insuring, and operation. The plans may be administered solely by the employer or labor union or administered jointly by trustees representing both labor and management. Plans may be financed solely by employer contributions or by joint contributions from employers and employees. The payment of benefits may be guaranteed in whole or in part by an insurance company; on the other hand, the plan may be self-insured; that is, it may accumulate reserves to meet anticipated payments. Pension plans, in particular, utilize a wide variety of methods of operation. A relatively few are completely non-funded, so-called pay-as-you-go plans under which payment of benefits is wholly dependent upon the ability of the employer or the pension fund to meet the obligations as they fall due.

A.Tr.

WELFARE ISLAND, formerly **BLACKWELLS ISLAND**, now officially known as **FRANKLIN D. ROOSEVELT ISLAND**, island in the East R. between the borough of Manhattan, by which it is administered, and the borough of Queens on Long Island (see **NEW YORK CITY**). The island has a maximum length of 1¼ mi. and a maximum breadth of 750 ft. It is used by the City of New York to house municipal welfare institutions, a number of which have been recently closed. In 1969 construction of a tunnel was begun to provide train service connecting the island with Manhattan and Queens, and construction of a housing project was begun on the island in 1972.

WELFARE WORK. See **SOCIAL WORK**.

WELL. See **ARTESIAN WELL**; **WATER SUPPLY AND WATER WORKS**.

WELLAND SHIP CANAL, formerly **WELLAND CANAL**, Canadian waterway, Ontario Province, and linking Lake Ontario and Lake Erie. Lying



Orson Welles played Falstaff in *Chimes at Midnight* (1965), a film based on Shakespeare that he wrote and directed.

parallel to the Niagara R. and 25 mi. long, it extends from Port Weller, on Lake Ontario, to Port Colborne, on Lake Erie. There are eight locks with a lift of 326 ft. The original Welland Canal, containing twenty-five locks, was completed in 1833. Reconstruction of the waterway was begun in 1913; it was opened to traffic as the Welland Ship Canal in 1932. The canal later became part of the Saint Lawrence Seaway (q.v.).

WELLER, Thomas Huckle (1915–), American physician, born in Ann Arbor, Mich., and educated at the University of Michigan and Harvard University. He taught bacteriology at Harvard University in 1941 and 1942. A member of the medical corps of the United States Army during World War II, Weller was stationed at the Antilles Department Medical Laboratory in Puerto Rico until 1946. He returned to Harvard in 1947, and was named professor and head of the department of tropical public health of the university in 1954. He was also on the staff of Children's Hospital Medical Center, Boston, in 1941 and 1942 and from 1946 to 1955.

Weller shared the 1954 Nobel Prize in medicine or physiology with two American co-workers, the bacteriologist John Franklin Enders and the pediatrician Frederick Robbins (qq.v.). They were cited for their discovery in 1948 of the

technique for growing poliomyelitis (q.v.) virus in nonnervous tissue cultures, making possible the eventual mass production of polio vaccine and the isolation of other viruses.

WELLES, (George) Orson (1915–), American actor, producer, director, and writer, born in Kenosha, Wis., and educated at the Todd School, Woodstock, Ill. He appeared with the Gate Theater in Dublin, Ireland, in 1931–32, and toured the United States as a member of the company of the American actress Katharine Cornell (q.v.) in 1933–34. After directing and acting in several productions for the Federal Theater Project in New York City, in 1937 he formed his own company there, the Mercury Theatre, for which he directed and acted in a modern-dress version of *Julius Caesar* (1937) and other plays. Beginning in 1934 Welles also wrote, directed, and acted in radio plays and appeared on television. In his most notable radio broadcast (1938), a version of *War of the Worlds* by the English novelist H(erbert) G(eorge) Wells (q.v.), he and the Mercury Theatre troupe convinced many in the listening audience that an invasion from Mars was in progress, causing panic in a number of communities. His first motion picture, which he coauthored, produced, and directed, and in which he starred, was *Citizen Kane* (1941), the story of a newspaper magnate, believed to be modeled on the life of the American newspaper

publisher William Randolph Hearst (q.v.). This film, made when Welles was twenty-five years old, was voted "the best film in motion picture history" in an international film-critic poll in 1962. Since then he has appeared in and directed many films and a number of plays. His most important film productions include *The Magnificent Ambersons* (1942), *Journey into Fear* (1942), *The Lady From Shanghai* (1946), *Othello* (1955), *Touch of Evil* (1957), and *L'Histtoire Immortelle* ("The Immortal Story", 1968), made in France. In 1970 he appeared in the film *Catch-22*. In 1975 Welles received the life achievement award of the American Film Institute.

WELLES, Sumner (1892-1961), American diplomat and writer, born in New York City, and educated at Harvard University. He entered the diplomatic service of the United States government in 1915. After periods of duty in various countries of South America and the Caribbean region, he became principal authority in the State Department on Latin American affairs. Welles was assistant secretary of state from 1933 to 1937, and afterwards undersecretary of state until his resignation in 1942. He was one of the chief architects of the so-called good neighbor policy proclaimed by President Franklin Delano Roosevelt (q.v.); see UNITED STATES OF AMERICA, THE: *History: Between the Two World Wars: The Roosevelt Administration: Foreign Policy (1932-41)*.

WELLESLEY, town of Massachusetts, in Norfolk Co. 14 miles s.w. of Boston. It is mainly a residential town and the seat of Wellesley College (q.v.) for women. The few manufactures include electrical machinery, hosiery, building supplies, and paper boxes. The town was settled about 1660 and incorporated in 1881. Pop. (1960) 26,071; (1970) 28,051.

WELLESLEY COLLEGE, nonsectarian privately controlled college of liberal arts for women, located in Wellesley, Mass., about 14 mi. from Boston. The college was founded in 1870 and opened for instruction in 1875. It is primarily an undergraduate institution which confers the B.A., although a limited number of candidates are accepted for the M.A. degree in art and biological sciences. In 1975 the college library contained over 500,000 volumes and over 2000 different periodicals. The library also includes various special collections, such as the English Poetry Collection containing the world's most complete collection of Elizabeth Barrett Browning (see under BROWNING) manuscripts and letters, and the Plimpton Collection of Italian books and manuscripts. The Jewett Arts Center

houses facilities pertaining to the fields of art, music, and the theatre. The Whitin Observatory contains 6-inch, 12-inch, and 24-inch telescopes. The science facilities include the Margaret C. Ferguson Greenhouses, which contain botanical exhibits and facilities. In 1975 enrollment totaled 2033 students, including undergraduates and continuing education students. The faculty numbered 263, of whom over half were women. The endowment of the institution in 1973 was \$129,490,655.

WELLINGTON, city, port, and capital of New Zealand and capital of Wellington District, on the s. coast of North Island, e. of Cook Strait, and 310 miles s. of Auckland. The harbor provides a deep-water anchorage 3 mi. wide and 12 mi. long. Wellington is the chief seaport of New Zealand and an important railway and air-transport center. Building stone, fish, meat, dairy products, and hides comprise the major articles of commerce. Points of interest in the city include Parliament and other government buildings, Wellington College, Saint Patrick's College, Victoria University College (a constituent college of New Zealand University), and the Dominion Museum, which contains a notable collection of native Maori (q.v.) art. Founded in 1840 and the first settlement established by the New Zealand (colonizing) Company, Wellington became the capital in 1865, superseding Auckland. Pop. (1971) 135,515.

WELLINGTON, 1st Duke of, Arthur Wellesley, known as THE IRON DUKE (1769-1852), British soldier and statesman, born in Dublin, Ireland, and educated at Eton College and the Military Academy of Angers in France. He was commissioned as ensign in the British army in 1787 and was elected to the Irish Parliament in 1790. During the War of the First Coalition (1793-97), he participated in the unsuccessful campaign of 1794-95 against French forces in the Netherlands. In 1796 Wellesley, now holding the rank of colonel in the army, went to India where he subsequently received his first independent command. Richard Colley Wellesley (1760-1842), his brother, was appointed governor general of India in 1797. Arthur took part in several military campaigns; in the Battle of Assaye in 1803, he subdued the Marathas (q.v.), then the dominant people of India. Returning to England in 1805 he was rewarded with a knighthood and with election to the British Parliament.

Military Success. Wellesley was involved in the struggle against the French emperor Napoleon I (q.v.). He took part in military campaigns against France and her allies in Hannover

WELLINGTON

(1805–06) and in Denmark (1807). In 1808 he was given command of the British expeditionary forces in Portugal, where in 1810 he first made use of his famous military tactic known as the scorched-earth policy, laying waste to the countryside behind him as he and his troops moved on. In the ensuing Peninsular War (1808–14),



The 1st Duke of Wellington, portrait (1812) by the Spanish painter Francisco José de Goya y Lucientes.

Bettmann Archive

which resulted in the expulsion of Napoleon's armies from Portugal and Spain, Wellesley's troops won a series of victories, especially at Talavera de la Reina (1809), Salamanca (1812), Vitoria (1813), and Toulouse (1814); see NAPOLEONIC WARS. His success in Spain won him many honors and large estates and cash awards. In 1814 he was created 1st duke of Wellington.

Wellington was the chief British representative at the Congress of Vienna, which met to decide the fate of post-Napoleonic Europe; see VIENNA, CONGRESS OF. Deliberations at Vienna were interrupted in February, 1815, by Napoleon's escape from Elba and his return to France and resumption of hostilities against the allies. Wellington assumed command of the main allied armies. On June 18, 1815, with the help of forces under the Prussian field marshal Gebhard

Leberecht von Blücher (q.v.), Wellington decisively defeated Napoleon at the Battle of Waterloo; see WATERLOO, BATTLE OF. He remained in France for the next three years as head of the allied army of occupation.

In 1818, Wellington returned to England and was given a post in the Tory (q.v.) cabinet headed by the statesman Robert Banks Jenkinson, 2nd Earl of Liverpool (1770–1828). He left the cabinet in 1827 upon his appointment as commander in chief of the British army. At the insistence of King George IV (q.v.), he was named prime minister in 1828. As prime minister Wellington antagonized the Tory Party by forcing passage of the Catholic Emancipation Act (q.v.) in 1829. Soon thereafter he provoked the British electorate by opposing parliamentary reform, an issue that forced his resignation as prime minister and the formation of a Whig (q.v.) ministry in 1830. He remained in Parliament and in 1834–35, when the Tories returned to power, was foreign minister in the cabinet of Sir Robert Peel (q.v.). In 1842 Wellington was again made commander in chief of the British army, a post he retained until his death. He died at his home, Walmer Castle, Kent, and was buried in Saint Paul's Cathedral in London.

As a soldier, Wellington was masterful in battle, but not in managing a campaign. As a politician his limitations were even more serious; his uncompromising attitudes alienated the people with whom he worked, and his unyielding support of the aristocratic institutions in which he believed was not in accord with the liberal spirit of his time. His undoubted courage and integrity, however, won him the lasting respect of the British people.

WELLS, H(erbert) G(eorge) (1866–1946), British author and political philosopher, born in Bromley, Kent, and educated at the University of London. He served as a draper's apprentice, bookkeeper, tutor, and journalist, until 1895, when he became a full-time writer. In the next fifty years he produced more than eighty books.

His first successful novel *The Time Machine* (1895), mingled science, adventure, and political comment. Later works of his in this genre are *The Invisible Man* (1897), *The War of the Worlds* (1898), and *The Shape of Things To Come* (1933); each of these fantasies was made into a popular motion picture. *The War of the Worlds* was also the basis of a 1938 radio broadcast produced by the American actor and producer (George) Orson Welles (q.v.) that caused several hours of virtual panic in the United States when people believed that an invasion from Mars was actually taking place.

Wells also wrote several novels devoted to the delineation of character. Among these the best known are *Kipps* (1905) and *The History of Mr. Polly* (1910), both of which depict members of the lower middle class and their confused and often humorous attempts to better themselves. Many of his other books can be categorized as thesis novels. Among these are *Ann Veronica* (1909), promoting women's rights; *Tono-Bungay* (1909), attacking irresponsible capitalists; and *Mr. Britling Sees It Through* (1916), depicting the average Englishman's reaction to war.

After World War I Wells wrote an immensely popular historical work, *The Outline of History* (2 vol., 1920). This chronological history of the world from the beginning of time through



H. G. Wells

British Information Services

World War I was praised by the average reader and condemned by historians. *A Short History of the World* (1922) followed. He wrote a lengthy, authoritative compendium of scientific knowledge, *The Science of Life* (4 vol., 1929–31), with his son George Philip Wells (1901–) and the British biologist Sir Julian Sorell Huxley (see under HUXLEY).

Throughout his long life Wells was deeply concerned with and wrote voluminously about the problems of contemporary civilization. For a time he was a socialist and he became a mem-

ber of the Fabian Society (q.v.) in 1903. He envisioned a Utopia in which the vast and frightening material forces available to modern man would be rationally controlled for progress and for the equal good of all men. His later works were increasingly pessimistic. '42 to '44 (1944) castigated most of the world leaders of the period; *Mind at the End of Its Tether* (1945) expressed the author's doubts about the ability of mankind to survive.

At the age of seventy-seven Wells was awarded a D.Sc. degree from the University of London for his thesis on human personality. He wrote the notable, *An Experiment in Autobiography* (1934).

WELLS, FARGO AND COMPANY, American express company (q.v.). See also FARGO, WILLIAM GEORGE.

WELS, city of Austria, in Upper Austria Province, on the Traun R., 16 miles s.w. of Linz. The transportation hub of the Innviertel district, which raises grains, cattle, and poultry, the city includes among its industries food processing and dairying and the manufacture of agricultural equipment and earthenware. Nearby are natural-gas wells, first developed in 1891, and a large hydroelectric plant. An annual fall folk festival is held here, and the city contains a museum of prehistoric and Roman remains, a 9th- to 15th-century Gothic parish church, the Renaissance Polheim Castle where Maximilian I (q.v.), Holy Roman Emperor, died in 1519, and numerous baroque buildings. The Roman town of Ovilava was founded on the site in 15 b.c. and later served as a barrier to invading Avars and Magyars. Wels was the seat of local dukes in the 8th century; the modern city started in the 11th century. Pop. (1971) 47,279.

WELSBACH, Baron Carl Auer von (1858–1929), Austrian chemist and inventor, born in Vienna, and educated at the Rupert Karl University of Heidelberg, where he studied under the German chemist Robert Wilhelm Bunsen (q.v.). Welsbach discovered the rare-earth elements neodymium and praseodymium in 1885 and was the first to devise a practical use for rare-earth elements; see RARE EARTHS. By placing an incandescent mantle of gauze, impregnated with oxides of thorium and the rare-earth element cerium around a gas flame, Welsbach greatly increased the amount of light generated by the flame; see FLAME; GAS. Patented in 1885, this discovery, known as the Welsbach mantle, would have greatly improved the lighting of city streets had it not soon been outmoded by electric lighting (q.v.). In 1898 he invented the osmium-filament lamp; see OSMIUM. The osmium fila-

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ment lasted longer than the carbonized thread then used in the electric light, but osmium was so rare a metal that it was not practical. Welsbach's most useful discovery was an alloy of iron and cerium, pyrophoric ferrocerium, which yielded hot sparks when struck and led to the development of pocket lighters.

WELSH LANGUAGE, native tongue of Wales, called by its speakers *Cymraeg* (Welsh *Cymro*, "Welshman", lit. "fellow countryman"). It derives from the Brythonic variation of Celtic, which is a branch of the Indo-European family of languages; see **CELTIC PEOPLES AND LANGUAGES**; **INDO-EUROPEAN LANGUAGES**. Recent statistics indicate that about 750,000 people in Wales speak Welsh, very few of them speaking Welsh only. In the last twenty years, several schools in Wales have used Welsh as the medium of instruction, including some secondary schools. Organizations such as the Society for the Welsh Language are making notable progress in the effort to save the Welsh language from dying out, and to assure in Wales official status for Welsh along with English.

Distinguishing Characteristics. Welsh, the Brythonic branch of Celtic, is marked by, among other things, its treatment of the Indo-European *qu*, which became *p*, whereas in Irish it became a *k* sound (written *c*); see **GAELIC LANGUAGE**. Thus Welsh *pump* (five) corresponds to Old Irish *coic*. Welsh has lost most of the final syllables of Brythonic and has reduced medial ones. Case endings of the noun have vanished, but the verb has an elaborate inflection. A systematic alternation of consonants, called mutation, plays a role, as in all Celtic languages. For example, what would have been in ancient Brythonic *landa Petri* (Peter's chapel), became *llan Bedr*; ancient *genetta teka* (pretty girl) is Welsh *geneth deg*. Vowels undergo change also: Brythonic *bardi* (poets) is now *beirdd*; but Brythonic *bardos* (poet) is Welsh *bardd*, with retention of the letter *a*. See **GRIM'S LAW**.

Welsh spelling is phonemic, representing unambiguously the pertinent sounds; see **PHONETICS**. In most cases a Welshman will know how to pronounce a word he has never seen before. Yet the letter *w* can represent either a consonant or a vowel, and *y* stands for two vowel sounds. The consonant *f* has the sound of English *v*; *ff* of *f*; *dd* of *th*, as in *then*; and *th* of *th*, as in *thin*. Popular attempts to describe pronunciation of double *l* (*ll*) all fail. It is a voiceless lateral fricative, and facile comparison to English *thl* is invalid. Welsh words are accented on the next to last syllable, and also have a characteristic intonation.

History. Scholars recognize three periods of Welsh: Old (800–1100), Middle (1100–1500), and Modern (since 1500). Old Welsh survives only in isolated words and names, plus a few lines of verse. The other periods are amply represented in literature. See **WELSH LITERATURE**. Welsh has borrowed words throughout all these periods from Latin, Anglo-Saxon, Norman French, and extensively from English, but it still has a large native vocabulary of Celtic origin. Forty dialects have been identified in Wales. Standard Welsh has a northern and southern variety.

WELSH LITERATURE, literature written in the Welsh language (q.v.). The earliest Welsh poetry is ascribed to Aneirin and Taliesin, two 6th-century poets living in Welsh territory far north, in what is now part of Scotland. Their poems survive, greatly altered, in *The Book of Aneirin* and *The Book of Taliesin*, 13th-century manuscripts which, together with *The Black Book of Carmarthen* (12th cent.) and *The Red Book of Hergest* (14th–15th cent.), comprise the *Four Ancient Books of Wales*. The poems fall mainly into two categories, eulogies which sing the praise of kings and heroes and elegies which lament the ruin and desolation of the world and express longing for days gone by.

The first important prose work in Welsh was the 10th-century law code, *The Laws of Hywel Dda*. In the next century appeared the prose masterpiece *The Four Branches of the Mabinogi*, a collection of superb tales, reflecting ancient myth and half-forgotten tradition, written down by an unknown author of exceptional skill. To these were added four independent native Welsh tales and three Romances reimported from France; the latter, having originally gone to France from Wales, hold certain strands of the Arthurian cycle (q.v.). All of these tales were translated (1849) by Lady Charlotte Elizabeth Guest (1812–95); Lady Guest weakened them, however, by omitting passages offensive, in her judgment, to children. An exemplary translation (1948) by the British scholars Gwyn Jones (1907–) and Thomas Jones (1871–1950), which continues Lady Guest's misnomer *Mabinogion* as its title, has superseded all others.

The Bardic Guilds. Meanwhile there had arisen a school of bards organized in guilds which set very precise standards for writing and reciting. The highest class of bard was the *pen-cerdd* ("chief of song"); next in rank was the *bardd teulu* ("household bard"); and lowest in stature was the *cerddor* ("minstrel"). All three were assigned definite themes, rights, and duties in the court of the prince. To some extent the office of bard was inherited, but all were

supposed to pass the guild's test of proficiency.

Bardic rules were often ignored, however, and, despite a certain amount of conventional literature, poems of true genius did appear. Occasionally the bard was himself a prince and enjoyed great artistic freedom, as, for example, Owain Cyveiliog (d. 1197). Perhaps the master of all bards was Cynddelw (fl. 1150–1200). Others of renown were Gruffydd ab Cynan (fl. 1150–1200) and Gruffydd ap yr Ynad Coch (fl. 1250–1300).

The Age of the Cywydd. The conquest of Wales by Edward I (q.v.), King of England, in the 13th century almost eradicated the bardic tradition there. A revitalization of poetry occurred, however, with the work of Dafydd ap Gwilym (1325–80), foremost of all Welsh poets and one of the great poets of medieval Europe. Writing of nature, beauty, and love with both passion and humor, he used a flexible verse form called the *cywydd*. The *cywydd* reached its fruition in the works of such 15th-century poets as Lewis Glyn Cothi (fl. 1450–86), Dafydd Nanmor (fl. 15th cent.), Guto y Glyn (fl. 1430–68), and Tudur Aled (fl. 1480–1525).

Decline and Revival. Between the 11th and the 16th centuries there was a conspicuous decline in Welsh prose, and from the 16th century on, most prose was religious and didactic. Noteworthy are the translation of the New Testament into Welsh (1567) by the Welsh scholar William Salesbury (1520?–1600?) and that of the whole Bible by Bishop William Morgan (1541–1604); Morgan's translation, as later amended, is still the standard Welsh Bible. An outstanding prose work of the 18th century is *Gweledigaeu y Bardd Cwsc* ("Visions of the Sleeping Bard", 1703), a keen satire on worldly follies by Ellis Wynne (1671–1734). The period between the 16th and 18th centuries was one of decay also in Welsh poetry. Many educated Welshmen turned to English as their medium of expression. Although thousands of anonymous popular poems, including ballads, were written during this time, very few were of any great merit.

A literary renaissance occurred, however, in the 18th century, inspired in part by Goronwy Owen (1723–69), who revived the classical *cywydd* and composed polished verses in the manner of the English neoclassic poet Alexander Pope (q.v.). His chief follower was the poet Eben Vardd (1802–63). Poetry in the so-called free forms, that is, in forms not written according to bardic meters, also began to flourish. Outstanding among a school of hymn writers were William Williams of Pantycelyn (1717–91) and Anne Griffiths (1776–1805). Secular writers

in the free forms included John Blackwell (1797–1840), Ieuan Glan Geirionydd (1795–1855), Owen Wynne Jones (1828–70), and John Ceiriog Hughes (1832–87).

Among nonfictional prose writers of the 19th century Samuel Roberts (1800–85) made a name as a political polemicist. The first important novelist in the Welsh language was Daniel Owen (1836–95), in whose works some see similarity to those of the English author Charles Dickens (q.v.).

Modern Welsh Writers. The 20th century brought a tremendous surge of literary activity in Wales. The poets T. Gwynn Jones (1871–1949) and Robert Williams Parry (1884–1956) produced distinguished poetry in the classic tradition, and W. J. Gruffydd (1881–1954) produced excellent work in the freer meters. Sir John Morris-Jones (1864–1929), a noted scholar but a true poet in temperament and inspiration, is celebrated for his "Salm i Famon" ("A Psalm to Manon"), now regarded as a landmark in Welsh poetry because of its purity of diction and technically exact use of the classical meters. His lyrics, in the freer forms, are also practically unsurpassed in 20th-century Welsh poetry, and his felicitous translations of poems from other languages equal any of the best known ones. Using a simpler, more intimate style, T. H. Parry-Williams (1887–), enriched Welsh poetic language and set the model for later poets who, like him, couch subtle thoughts in colloquialisms and everyday vocabulary. He usually employs simple metrical forms but excels as well in the more rigid form of the sonnet (q.v.). Parry-Williams is also considered by some critics the most eloquent and vigorous 20th-century Welsh essayist. Among the younger poets, Bobi Jones (1929–) is recognized as a master of both ancient and modern meters. He has a gift for transforming homely words and well-known expressions into strikingly new combinations, delighting and startling the ear and eye alike. Bobi Jones is also a skilled short-story writer. Other outstanding modern poets include D. Gwenallt Jones (1899–1969), T. E. Nicholas (1879–1970), and Prosser Rhys (1901–45).

Welsh 20th-century prose has been equally reinvigorated by a flood of fresh talent. Amply representing the short story are Kate Roberts (1891–), widely regarded as the most profound and accomplished of all; D. J. Williams (1885–1969), also an essayist; E. Tegla Davies (1880–); Amy Parry-Williams; Idwal Jones; Elena Puw Morgan; and Islwyn Williams. Superior novelists include T. Rowland Hughes (1903–49), Islwyn Fflowc Elis (1924–), and John

WELSH SPRINGER SPANIEL

Rowlands. Saunders Lewis (1893–), who excels in all the literary forms previously cited, is also a playwright of distinction. Another important dramatist is J. Gwilym Jones, who is also known for his short stories.

It should be noted that an impressive number of Welshmen are successful authors in English, for example, Dylan Thomas (q.v.), the renowned lyric poet and short-story writer. The continued existence of Welsh literature, however, is inevitably bound to the fate of the Welsh language, which is now struggling valiantly for its life.

WELSH SPRINGER SPANIEL, breed of spaniel (q.v.) known in Wales and western England for several centuries, and popular today particularly in Scotland, England, the United States, Australia, India, and Thailand. The Welsh springer spaniel, which weighs from 33 to 40 lb., is smaller than the English springer spaniel which it otherwise resembles in a number of ways. It is larger, however, than the cocker spaniel, and because of its longer legs it can cover ground more quickly than the cocker. The Welsh springer spaniel has a skull that is of moderate length and slightly domed; small ears that taper towards the tip; eyes of medium size that are hazel or dark in color; long and muscular shoulders and neck; and a strong, compact, muscular body. It has a silky coat, red and white in color, which is straight or flat and thick. The animal is active, and is noted for its endurance and ability to stand extremes of heat and cold. It is most useful as a gun dog, is a good water dog, and makes an excellent watchdog and pet.

WELSH TERRIER, type of terrier that supposedly originated in Wales approximately two centuries ago, but was not recognized as a sepa-

rate breed until 1884; up to that time the dog was known either by its present name or as the old English terrier. The Welsh terrier was imported into the United States in 1888, and its popularity since that time has steadily increased. The dog is used for hunting the otter, fox, and badger, and also makes an excellent watchdog or pet. The Welsh terrier has a flat skull; a powerful jaw; v-shaped ears; small, dark-hazel eyes; a moderately long and thick neck; and straight, muscular legs. It has a wiry, hard, abundant coat, which is black and tan in color; it is 15 in. high at the shoulder and weighs about 20 lb.

WELTY, Eudora (1909–), American writer, born in Jackson, Miss., and educated at Mississippi State College for Women and the University of Wisconsin. Set usually in her native State, most of her stories and novels are tales of eccentric and even grotesque characters, whom she depicts with charm and humor. Many of the short stories that brought her fame first appeared in *The New Yorker* magazine. Her works include a collection of short stories entitled *A Curtain of Green* (1941) and the novels *Delta Wedding* (1946), *The Ponder Heart* (1954), and *Losing Battles* (1970).

WENATCHEE, city in Washington, and county seat of Chelan Co., on the Columbia R., at the mouth of the Wenatchee R., 95 miles E. of Seattle and 140 miles W. of Spokane. The city is served by railroad and maintains an airport. The city had food-processing plants and lumber mills. It is the shipping point and distributing center of five fertile valleys comprising one of the greatest apple-growing districts in the world. In addition, the surrounding agricultural

Welsh terrier

Percy T. Jones



area yields peaches, pears, cherries, prunes, apricots, and wheat. The Wenatchee area is also a dairying and mining region, especially noted for its copper mines. The city was founded in 1888 and chartered in 1890. Pop. (1960) 16,726; (1970) 16,912.

WENCHOW, city and port of the People's Republic of China, in Chekiang Province, on the Wu R., 160 miles S.E. of Hangchow. Formerly known for its trade in tea, tin vases, and lamps, Wenchow now exports lumber, bamboo, tea, tobacco, and citrus fruits, and remains a trade center of an area growing tea, oranges, and cotton. The city includes among its industries paper milling, food processing, tanning, and the manufacture of wood products and straw mats. The settlement dates from the 4th century, and the port was opened to foreign trade in 1876. From 1912 to 1949 the city was known as Yung-kia. The name is also spelled Wen-chou. Pop. (1970 est.) 250,000.

WENDS, name given by the Germans in medieval times to all the Slavic tribes occupying the territory roughly between the Elbe and Saale rivers on the west and the Oder R. on the east. German rulers waged wars against the powerful Wends from about the 6th century, conquering and Christianizing them in the 12th century. A fragment of the Wends, which calls itself Sorbs, or Serbs, has survived to the present day. The Sorbs number about 155,000 and are centered largely in the valley of the upper Spree R. in Lusatia, a region of eastern Germany and southwestern Poland. Their language, Wendish, or Sorbian, is a West Slavic language similar to Polish and Czech. See SLAVS.

WENTWORTH. See ROCKINGHAM, CHARLES WATSON-WENTWORTH, 2ND MARQUIS OF; STRAFFORD, SIR THOMAS WENTWORTH, 1ST EARL OF.

WENTWORTH, William Charles (1793–1872), Australian statesman, born on Norfolk Island, and educated in England at the University of Cambridge. He practiced law in Sydney, New South Wales, and in 1824 helped found the newspaper the *Australian*, in which he advocated a greater measure of self-rule for the colony. A spokesman also for the emancipists, as former convicts who had been transported from England were called, he led their fight to overcome the political supremacy exercised by government officials and voluntary settlers; see AUSTRALIA: *History*. In 1842 New South Wales became the first Australian colony to be granted representative government, largely as a result of Wentworth's efforts. A member of the legislative council formed that same year, he helped obtain a formal constitution for the colony in

1854. Meanwhile, in 1850, he was responsible for passage of the bill founding the University of Sydney. Although he wanted self-rule for British colonies, as a wealthy landowner he disapproved of the growing democracy in Australia, and in 1862 he settled in England. Wentworth is often called "the Australian patriot".

WEREWOLF (AS. *wer*, "man"; *wulf*, "wolf"), according to a widespread superstition, a man who is transformed, or who transforms himself, into a wolf in nature and appearance. Lycanthropy, the delusion that one has become a wolf, was known among the ancients, and examples are given in works of several classical writers.

WERFEL, Franz (1890–1945), Austrian author, born in Prague. After attending the University of Prague for two years, he held a variety of positions in Prague and Leipzig and, although a pacifist, served in the Austrian army in World War I.



Franz Werfel

Bettmann Archive

But writing was his major interest; a poem of his was published as early as 1908 and his first play appeared in print in 1910. By the end of the war, his reputation was established in Austria and Germany as a novelist, poet, and dramatist.

After World War I, Werfel settled in Vienna. He remained there until 1938, when Austria was occupied by the National Socialist forces of Germany. For the next two years Werfel, a Jew, lived in France. In 1940, when the Germans invaded France, he fled again, this time to the

United States, where he spent the last five years of his life.

Throughout his life Werfel was fascinated by the theater. Among his plays are *Juarez und Maximilian* (1924), basis of the American motion picture *Juarez* (1939); and *Jacobowsky und der Oberst* (1944), adapted by the American author Samuel Nathaniel Berman (q.v.) into a successful theatrical comedy, *Jacobowsky and the Colonel* (1944), and a motion picture, *Me and the Colonel* (1958).

Werfel also wrote several novels, one of which, *Die Vierzig Tage des Musa Dagh* (1933; Eng. trans., *The Forty Days of Musa Dagh*, 1934), an epic tale of Armenian resistance to Turkish invaders, had a remarkable success in the U.S. In *Das Lied von Bernadette* (1941; Eng. trans., *The Song of Bernadette*, 1942), which became a popular American film (1944), Werfel shows his sympathy with Roman Catholicism as he recounts the incidents leading to a young girl's sainthood. See also GERMAN LITERATURE: *Expressionism*.

WERNER, Abraham Gottlob (1750–1817), German geologist and mineralogist, born near Bol-esławiec (now in Poland), and educated at the mining academy in Freiburg and at the University of Leipzig. He became an instructor at the Freiburg mining academy in 1775 and subsequently attained the rank of professor.

Werner helped to establish geology and mineralogy (qq.v.) as two distinct sciences and was the first investigator to classify minerals systematically. He was also the founder of economic geology; see GEOLOGY, ECONOMIC. As leader of the Neptunist school of geology, Werner put forth the theory that all stratified rocks had an aqueous origin. This view was opposed by the Plutonic school of the British geologist James Hutton (1726–97), whose theories ultimately prevailed. See GEOLOGY: *History*.

WERNER, Alfred (1866–1919), Swiss chemist, born in Mulhouse, France, and educated at the universities of Karlsruhe and Zürich. He was professor of chemistry at the University of Zürich from 1893 to 1915 and served as the director of the Chemical Institute in Zürich from 1909 to 1915.

Werner's research concerned the structure of complex inorganic compounds and the stereochemistry of nitrogen compounds, and his work helped explain isomerism; see ION; IONIZATION. He is best known for his coordination theory of valence (q.v.), which he introduced in 1893 to account for the structure of complex inorganic compounds that cannot be explained by classical valence theory. He postulated that metal

ions possess coordinate valence bonds, by which they may combine with a definite number of other molecules or ions, in accordance with a definite geometrical pattern. For his coordination theory Werner was awarded the 1913 Nobel Prize in chemistry. Among other books he wrote *Lehrbuch der Stereochemie* ("Textbook of Stereochemistry", 1904).

WERTHEIMER, Max. See GESTALT PSYCHOLOGY. **WESER**, river of West Germany, about 300 mi. long, and formed by the confluence of the Werra and Fulda rivers. It flows generally northwestward from Münden, in s.e. Lower Saxony, and empties into the North Sea s. of Bremerhaven, forming a large estuary. The Weser is navigable throughout its course and is connected by canal with the Elbe, Rhine, and Ems canal systems. Its chief tributaries are the Diemel, Hunte, and Aller.

WESLACO, city of Texas, in Hidalgo Co., near the border with Mexico, about 18 miles w. of Harlingen. A processing and marketing area, vegetables and citrus fruits are packed and canned. The city also has some manufacturing. Weslaco was incorporated into a city in 1921. Pop. (1960) 15,649; (1970) 15,313.

WESLEY, name of two British brothers prominent in the history of Methodism (q.v.).

John Wesley (1703–91), theologian, evangelist (q.v.), and founder of Methodism, born in the rectory at Epworth, Lincolnshire, and educated at Charterhouse School and Christ Church, University of Oxford. He was the fifteenth child of the British clergyman Samuel Wesley (1662–1735). Ordained deacon in 1725 and admitted to the priesthood of the Church of England (q.v.) in 1728, John Wesley acted for a time as curate to his father. In 1729 he went into residence at Oxford as a fellow of Lincoln College. There he joined the Holy Club, a group of students that included his brother Charles (see below) and, later, George Whitefield (q.v.), who was to become the founder of Calvinistic Methodism; see CALVINISM. The club members adhered strictly and methodically to religious precepts and practices, among them visiting prisons and comforting the sick, and were thus derisively called "methodists" by their schoolmates.

In 1735 Wesley went to Georgia as an Anglican missionary. On the ship to Savannah he met some German Moravians, whose simple evangelical piety greatly impressed him; see MORAVIAN CHURCH; PIETISM. He continued to associate with them while in Georgia and translated some of their hymns into English. Except for this association, Wesley's American experience was a failure.



John Wesley preaching to the Indians.

Upon his return to England in 1738, he again sought out the Moravians; while attending one of their meetings in Aldersgate Street, London, on May 24, 1738, he experienced a religious awakening that profoundly convinced him that salvation was possible for every man through faith (q.v.) in Jesus Christ alone.

In March, 1739, George Whitefield, who had met with great success as an evangelist (q.v.) in Bristol, urged Wesley to join him in his endeavors. Despite his initial opposition to preaching outside the church, Wesley preached an open-air sermon on April 2, and the enthusiastic reaction of his audience convinced him that open-air preaching was the most effective way of reaching the masses. Few pulpits would be open to him in any case, for the Anglican Church frowned on revivalism; see REVIVALS, RELIGIOUS.

Wesley attracted immense crowds virtually from the outset of his evangelical career. His success also was due, in part, to the fact that contemporary England was ready for a revivalist movement; the Anglican Church was seemingly unable to offer the kind of personal faith that the people craved. Thus Wesley's emphasis upon inner religion and his assurance that each man was accepted as a child of God had a tremendous popular appeal.

On May 1, 1739, Wesley and a group of his followers, meeting in a shop on West Street, London, formed the first Methodist society. Two similar organizations were established in Bristol the same month. Late in 1739 the London society began to meet in a building called the Foundry, which served as the headquarters of Methodism for many years.

With the growth of the Methodist movement, the need for tighter organization became acute. In 1742 the societies were divided into classes, with a leader for each class. These class meetings contributed greatly to the success of the movement, but equally important were their leaders, many of whom Wesley designated lay preachers. Wesley called the first conference of Methodist leaders in 1744, and conferences were held annually thereafter.

In 1751, at the age of forty-eight, Wesley married Mary Vazeille (about 1710-81), a widow with four children. The marriage was not successful, and she finally left him; Wesley had no children of his own.

An indefatigable preacher and organizer, Wesley traveled about 5000 mi. a year, delivering as many as four or five sermons a day and founding new societies.

Wesley parted with the Moravians in 1740 because of doctrinal disagreements. He also rejected the Calvinist doctrine of predestination (q.v.), thus breaking with Whitefield.

He also discarded many tenets of the Church of England, including the doctrine of the apostolic succession (the maintenance of an unbroken line of succession of bishops of the Christian Church beginning with Saint Peter, q.v.), but he never voiced any intention of establishing the movement as a new church. Yet his actions made separation inevitable. In 1784 he issued the deed of declaration, which provided rules and regulations for the guidance of the Methodist societies. The same year he appointed his aide Thomas Coke (1747–1814), an Anglican clergyman, a superintendent of the Methodist organization in the United States (see METHODIST CHURCH, THE), empowering him to administer the sacraments (see SACRAMENT); other ordinations followed. Ordination represented the biggest step in the direction of a break with the Anglican Church; see ORDERS, HOLY. Separation did not take place, however, until after Wesley's death.

Wesley was deeply concerned with the intellectual, economic, and physical well-being of the masses. He was also a prolific writer on a wide variety of historical and religious subjects. His books were sold cheaply, so that even the poor man could afford to buy them; thus he did much to improve the reading habits of the general public. He aided debtors and those trying to establish businesses and founded medical dispensaries. He opposed slavery (q.v.) and was interested in social-reform movements of all kinds.

Wesley compiled twenty-three collections of hymns, edited a monthly magazine, translated Greek, Latin, and Hebrew works, and edited, under the title *The Christian's Pattern*, the noted medieval devotional work *De Imitatione Christi*, generally ascribed to the German ecclesiastic Thomas a Kempis (q.v.). His personal *Journal* (1735–90) is outstanding for the frank exposition of his spiritual development.

In the latter years of his life the hostility of the Anglican Church to Methodism had virtually disappeared, and Wesley was greatly admired. He was buried in the graveyard of City Road chapel, London, but there is a memorial plaque in Westminster Abbey (q.v.) inscribed with his name.

Charles Wesley (1707–88), clergyman and hymnist, born in the rectory at Epworth, Lincolnshire, and educated at Westminster School and Christ Church, University of Oxford. While

at Oxford he was a member, with his brother John, of the Holy Club.

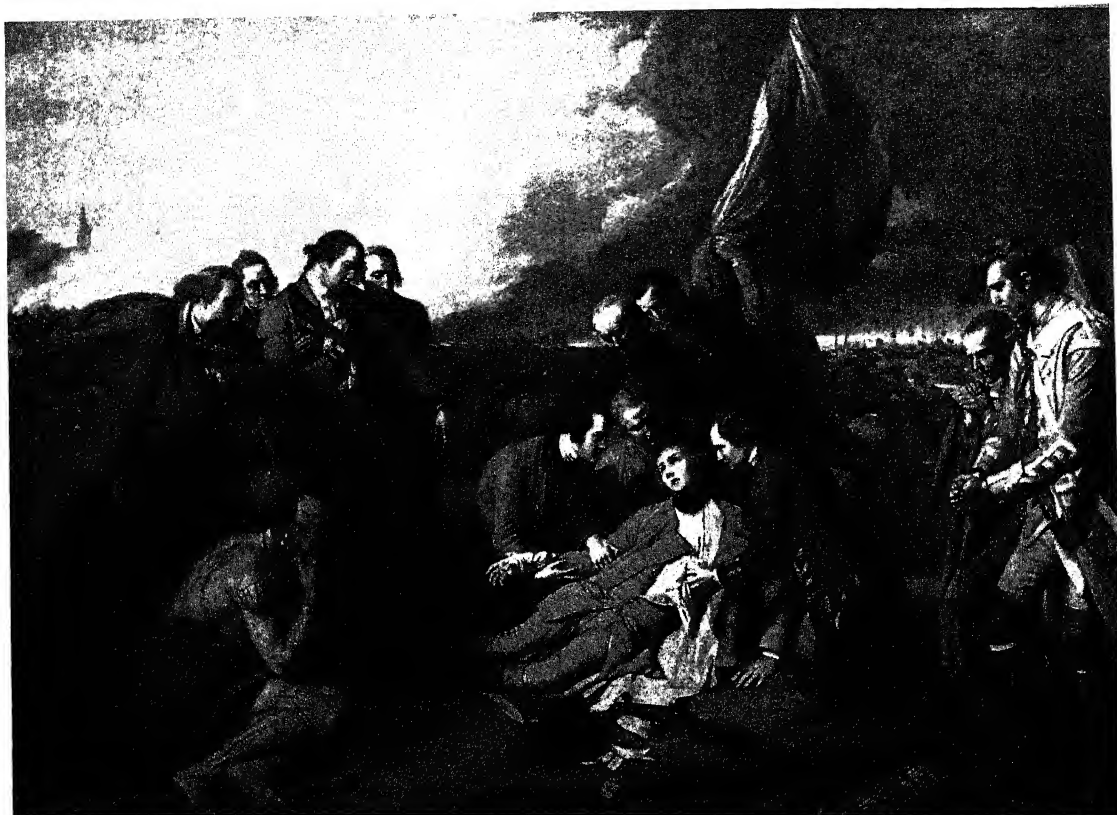
In 1735 Wesley was ordained in the Church of England. Later that year he went to Georgia with his brother John as secretary to the colonial governor James Edward Oglethorpe (q.v.). Ill health forced him to relinquish that post, however, and he returned to England the following year.

On May 21, 1738, Charles Wesley experienced a religious awakening akin to that which his brother John was to undergo three days later. Charles subsequently was closely associated with the Wesleyan movement and traveled extensively as an evangelical preacher. After 1756 he carried on his work chiefly in Bristol and in London, where he lived from 1771 on.

The two Wesleys differed on certain doctrinal matters. In addition, Charles strongly opposed steps that might lead to separation from the Church of England, and thus disapproved of John's ordinations. Charles Wesley is often called the poet of the Methodist movement. He composed almost 7000 hymns, many of which are still sung in Protestant churches. Among the most widely known are "Jesus, Lover of My Soul"; "Hark! The Herald Angels Sing"; and "Love Divine, All Love Excelling".

WESSEX, Anglo-Saxon kingdom in England, founded probably early in the 6th century by West Saxons under the leadership of Prince Cerdic (d. 534) and his son Cynric (d. 560). The frontiers of the kingdom were greatly extended by Cynric's son Cealwin (560–93), who became king on the death of his father. During the next century Wessex was usually ruled by other Saxon kingdoms, notably Mercia, Northumbria, and Kent (qq.v.). Under King Ine (r. 688–726), Wessex emerged as one of the strongest kingdoms on the island. Early in the 9th century, King Egbert (q.v.), having conquered Mercia, Northumbria, and several other kingdoms, including Essex and Kent, was acknowledged overlord of all England. During the reign of his grandson Alfred (q.v.), called the Great, the Danes, who had long harassed the Saxons, acknowledged the sovereignty of Wessex over all English territory not under Danish rule. Wessex then ceased to exist as a separate political entity. For subsequent developments, see ENGLAND: *History: The Wessex Supremacy*. The British novelist and poet Thomas Hardy (q.v.) gave the name "Wessex" to the region (mainly present-day Dorsetshire) which served as the setting for many of his writings.

WEST, Benjamin (1738–1820), American painter, born in Springfield (now Swarthmore), Pa., and largely self-taught. He painted portraits



in Philadelphia from 1746 to 1759 and in New York in 1759–60. He went to Italy in 1760 and acquired a classical style of painting by copying the works of such Italian masters as Titian and Raphael (qq.v.). In 1763 West moved to England, where he soon gained the friendship of the British portraitist Sir Joshua Reynolds and the patronage of King George III (qq.v.), who commissioned him to execute portraits of members of the royal family and, in 1772, appointed him historical painter to the court. West was a founder, in 1768, of the Royal Academy of Arts. On the death of Reynolds, its first president, in 1792, West succeeded to the presidency of the academy, remaining in the post for the rest of his life. He became a leader of the developing realist movement when his painting "The Death of Wolfe" (1770, National Gallery, Ottawa) broke the usual tradition of depicting soldiers in contemporary battle scenes wearing Greco-Roman costumes. West encouraged and influenced many young American painters who studied under him in London, among them Gilbert Charles Stuart and John Singleton Copley (qq.v.). Examples of his work include "Penn's Treaty with the Indians" (1772, Independence Hall, Philadelphia) and "Christ Healing the Sick" (1801, National Gallery, London).

WEST, Nathanael, pen name of NATHAN WALLENSTEIN WEINSTEIN (1904–40), American

"The Death of Wolfe" (1770) by Benjamin West.

National Gallery of Canada, Ottawa

novelist, born in New York City. After graduating from Brown University in 1924, he lived briefly in France, then worked as a clerk in various hotels in New York City. His first novel, *The Dream Life of Balso Snell* (1931), was not successful. *Miss Lonelyhearts* (1933), his best-known book, tells of the confrontations between a bitter male advice-to-the-lovelorn columnist and his correspondents. It was followed by *A Cool Million* (1934), a satire of the moralistic rags-to-riches sagas popular in the 1890's. His last novel, *The Day of the Locust* (1939), savagely depicts a gallery of grotesques in Hollywood, where West worked as a screenwriter.

Although his early death in an automobile accident limited West's output to four novels, the popularity of his books, as well as his critical reputation, has consistently increased.

WEST, Dame Rebecca, pen name of CICILY ISABEL FAIRFIELD ANDREWS (1892–), British novelist, critic, and journalist born in County Kerry, Ireland, and educated at George Watson's Ladies' College, Edinburgh, Scotland. As an actress she began to call herself Rebecca West after the heroine of the play *Rosmersholm*, by the Norwegian playwright Henrik Ibsen (q.v.). An ardent feminist and a member of the socialist Fabian Society (q.v.), she turned to

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writing and while still in her twenties won international recognition as a novelist, literary critic, and political analyst. In 1930 she married Henry Maxwell Andrews, a British banker. Her major nonfiction work, *Black Lamb and Grey Falcon* (1941), is a perceptive study of Yugoslavia from a historic point of view and the point of view of a tourist and a keen critique of modern culture. Miss West has been called the best woman journalist of Great Britain and the United States because of her psychological understanding and analytical skills. Her reports on the treason trials of notable Britishers after World War II for the *New Yorker* magazine were republished in *The Meaning of Treason* (1947). Other political essays and literary criticisms appeared in such magazines as the British *New Statesman* and the American *New Republic*. Collections of her nonfiction writings include *A Train of Powder* (1955) and *The New Meaning of Treason* (1964). Intelligence, wit, and beautifully detailed settings and characterizations mark her novels, including *The Thinking Reed* (1936), *The Fountain Overflows* (1956), and *The Birds Fall Down* (1966). She was created Dame Commander of the British Empire in 1959.

WEST ALLIS, city of Wisconsin, in Milwaukee Co., adjoining on the w. the city of Milwaukee, of which it is a residential and industrial suburb. Heavy machinery, turbines, tractors, and gasoline engines are manufactured in its principal industrial plants. West Allis was incorporated as a village in 1902 and as a city in 1906. Pop. (1960) 68,157; (1970) 71,723.

WEST BENGAL, State of the Republic of India, bordered on the n.e. and e. by Bangladesh, on the s. by the Bay of Bengal, on the s.w. by Orissa State, and on the w. and n.w. by Bihar State. See **BENGAL**.

WESTBROOK, city of Maine, in Cumberland Co., on the Presumpscot R., about 7 miles w. of Portland. Manufactures include machinery, textiles, and paper and wood products. Westbrook was incorporated as a town in 1814 and as a city in 1891. Pop. (1960) 13,820; (1970) 14,444.

WESTBURY, village of New York, in Nassau Co., on Long Island, about 2 miles s.w. of Hicksville. The village has manufactures of electronic equipment and metal products. It is the site of a harness race track. Settled in 1650, Westbury was incorporated in 1932. Pop. (1960) 14,757; (1970) 15,362.

WEST CHESTER, borough in Pennsylvania, and county seat of Chester Co., about 20 miles w. of central Philadelphia. Primarily residential, manufactures include machinery, pharmaceuticals, and metal products. It is the site of West

Chester State College, founded in 1812. West Chester was established in 1788, and incorporated as a borough in 1799. Pop. (1960) 15,705; (1970) 19,301.

WESTCHESTER, village of Illinois, in Cook Co., about 15 miles s.w. of central Chicago, of which it is a suburb. Westchester was incorporated in 1925. Pop. (1960) 18,092; (1970) 20,033.

WEST COVINA, city of California, in Los Angeles Co., on Walnut Creek north of the Puente and San Jose Hills, 18 miles e. of downtown Los Angeles. A trade center in an area of the eastern San Gabriel Valley growing citrus fruits and walnuts, West Covina manufactures precision electronic equipment. The city was incorporated in 1923. Pop. (1960) 50,645; (1970) 68,034.

WEST DES MOINES, city of Iowa, in Polk Co., a suburb about 6 miles w. of central Des Moines. Corn, wheat, and hay are grown in the surrounding area. Principal manufactures include electrical equipment, foundry products, cement, and metal nozzles. Incorporated as Valley Junction in 1893, the city received its present name in 1938. Pop. (1960) 11,949; (1970) 16,441.

WESTERLY, town in Rhode Island, and county seat of Washington Co., on the Pawcatuck R., which there forms the Connecticut boundary, about 27 miles s.w. of Newport. Transportation facilities include a railroad and a 100-ft. bridge over the river. The town is a summer resort and a manufacturing center. In the town and vicinity are extensive granite quarries; other industrial establishments in Westerly are commercial fisheries, textile mills, and factories producing color-printing presses, elastic webbing, wire-stitching machines, rubber goods, and cotton dyers and converters. The town, which comprises several villages, including Bradford and Watch Hill, provides 6 mi. of bathing beaches. Westerly was once an important shipbuilding center. Before the War of 1812 the American naval officer Oliver Hazard Perry (see *under* **PERRY**), built gunboats there. The first settlement on the site of the present town was established in 1648 and the town was incorporated in 1669. Pop. (1960) 14,267; (1970) 17,248.

WESTERMARCK, Edward Alexander (1862–1939), Finnish anthropologist, born in Helsinki, and educated at the University of Helsinki. From 1907 to 1930 he was professor of sociology at the University of London and simultaneously professor of moral philosophy at the University of Helsinki. Subsequently he was professor of philosophy at Turku University in Finland until his retirement in 1935.

Westermarck, who wrote most of his works in English, is best known for his study of marriage

customs; see FAMILY. His authoritative work *The History of Human Marriage* (1891) stresses the importance of the family unit throughout history. He is noted also for his sociological studies of Moroccan customs and for his research on the origins of moral ideas, which resulted in such studies as *The Origin and Development of the Moral Ideas* (2 vol., 1906–08).

WESTERN AUSTRALIA, largest State of the Commonwealth of Australia, bounded on the N., W., and S. by the Indian Ocean and on the E. by South Australia and Northern Territory. Except for the fertile S.W. coastal area known as Swanland, most of the State is a sandy, dry plateau with little vegetation. The highest point is Mt. Bruce (4024 ft.), situated in the N.W. portion. The climate varies from tropical in the N. to temperate in the S.W. Annual temperatures in the extreme N. average between 80° and 85° F. Precipitation, which occurs mainly during the summer season, is moderate. Swanland has temperatures ranging from 50° to 80° F. and rainfall varying from 20 to 50 in. annually; there the rainy season occurs in winter (May–October). The climate of the inland desert regions is characterized by more extreme temperature variations and scanty rainfall. Western Australia is the most sparsely settled State of the Commonwealth and one of the most sparsely settled regions in the world. Most of it is wholly uninhabited, the population being confined mainly to portions of the coast region and to the gold-mining settlements in the interior. Perth is the capital and largest city, and Fremantle is the chief port. Area, 978,920 sq.mi.; pop. (1971) 1,030,469.

Stock raising, mining, and fishing (including pearling) are the leading industries. The principal crops are wheat, oats, barley, hay, potatoes, tobacco, and orchard fruits. Livestock includes sheep, cattle, pigs, and horses. Western Australia leads the Commonwealth in gold production; Kalgoorlie is the center of the chief gold-mining region. Iron ore and bauxite are being mined in increasing quantities from recently discovered deposits. State forests and timber reserves covered an area of about 7,000,000 acres in the early 1970's.

Education is secular and free; primary school attendance is compulsory. Some 570 government schools and 385 nongovernment schools had an enrollment of about 162,000 and 50,000 pupils, respectively, in one year in the late 1960's. The University of Western Australia is located in Nedlands. About one half of the inhabitants are adherents of the Church of England. Other important denominations are the Roman Catholic, Methodist, and Presbyterian.

Executive power is vested in a governor, acting through a responsible ministry, and legislative power in a parliament of two houses, namely the Legislative Council, consisting of 30 members elected for six years, and the Legislative Assembly, consisting of 51 members elected for three years.

History. The coast of Western Australia was probably visited by Spanish and Portuguese navigators in the 16th century. In the following century the Dutch explorer Abel Janszoon Tasman (q.v.) surveyed the north coast. The west coast was only surveyed during later explorations. The earliest settlement was founded by British colonists in 1825. The British took formal official possession of the land in 1829. In that year the colonization of Western Australia was begun on a planned basis by a British organization, which received large land grants. Several thousand convicts from Sydney were numbered among the early settlers. It was not until 1870, however, that extensive efforts were made by the British to facilitate the development of the colony. On Jan. 1, 1901, Western Australia became a State of the Australian Commonwealth. **WESTERN BUG**, alternate name of a river in the Soviet Union. See BUG.

WESTERN DVINA. See DVINA.

WESTERN EMPIRE. See ROME, HISTORY OF: *The Empire: Decline and Fall* (193–476).

WESTERN EUROPEAN UNION, formerly BRUSSELS TREATY ORGANIZATION, association of European countries inaugurated in 1955. The union consists of Great Britain, France, Belgium, the Netherlands, and Luxembourg, the countries that established the Brussels Treaty Organization in 1948, and Italy and West Germany, the countries that acceded to it in 1954. The original and basic aims of the union are set forth in the Brussels Treaty, a fifty-year pact providing for "collaboration in economic, social and cultural matters and for collective self-defense".

The military functions of the organization are now performed by the North Atlantic Treaty Organization (q.v.), known as NATO, and most of its economic activities are handled by the European Economic Community (q.v.), popularly known as the Common Market. Cultural and social activities were transferred to the Council of Europe (q.v.) in 1960. The principal activities of the union, therefore, have been in regard to the defense effort of West Germany and to certain economic affairs of Great Britain until such time as it formally joins the Common Market. Meetings of the council of the union, consisting of the foreign ministers of the seven member na-

WESTERN ISLANDS

tions or their representatives, were held at the London headquarters at quarterly intervals after October, 1963.

WESTERN ISLANDS. See **HEBRIDES**.

WESTERN ONTARIO, UNIVERSITY OF, privately controlled coeducational institution of higher learning, located in London, Ontario, Canada. Originally affiliated with the Church of England, the school was chartered in 1878 as Western University of London, Ontario; instruction began in 1881. The Anglican connection was severed in 1908, and the present name was adopted in 1923. The university includes three affiliated colleges, Brescia College, Huron College, and King's College; faculties of arts, music, social science, science, engineering science, law, physical education, medicine, nursing, dentistry and graduate studies, offering graduate courses in most areas; schools of business administration and library and information service, and Althouse College of Education. The degrees of bachelor, master, and doctor are conferred. Extension and correspondence courses are offered. The university libraries contain approximately 1,000,000 bound volumes. In 1973-74 enrollment totaled 16,007 students, and the faculty numbered about 900.

WESTERN RESERVE, in United States history,

that part of the public lands in Ohio claimed by Connecticut under its charter of 1662, and reserved to it even when it ceded (1786) its claims to its western lands. The region began at the Pennsylvania boundary, extended 120 mi. westward, and comprised 3,667,000 acres. The reserve had no permanent government until 1800, when it was incorporated in the Northwest Territory (q.v.) as Trumbull County. Proceeds from sales of this land were allocated to the State school fund.

WESTERN RESERVE UNIVERSITY. See **CASE WESTERN RESERVE UNIVERSITY**.

WESTERN SAMOA, independent island nation in the South Pacific Ocean, in the large w. portion of the 300-mi.-long Samoan archipelago. Western Samoa lies between about lat. 13° S. and lat. 15° S. and long. 171° W. and long. 173° W., due w. of American Samoa. The land area of 1097 sq.mi. comprises two large islands, Savai'i and Upolu, and several smaller islands. Savai'i and Upolu are mountainous, fertile, and well watered, and the principal industry of the country is agriculture. The three main crops are cocoa, bananas, and copra.

The population (1971 census) is 146,635. The overall population density is 133.7 per sq.mi. (1971). Apia (pop. 1970 est., 28,880) is the capital and commercial center. Most Samoans live in about 400 seashore villages with populations

Samoan children tell the story of the United Nations in song.
United Nations



ranging from 100 to 500 persons. The Samoan people are a distinct branch of the Polynesian race and the religion of the majority is Christianity. English and Samoan are the official languages.

Education is as yet neither free nor compulsory, but according to latest information, more than 500 primary schools were attended by over 30,000 pupils, and 14 secondary schools by over 2000. One teachers' training college, 1 agricultural college, and 2 theological colleges are maintained. A number of Samoan students go abroad for higher education, often with scholarship aid.

The road system of Western Samoa consists of about 550 mi. of roads, and in 1971 registered vehicles totaled 2080. Faleolo Aerodrome is the airfield. Radio broadcasting is the responsibility of the government.

New Zealand has been the chief source of financial aid to Western Samoa and in 1965 the New Zealand government approved \$442,000 for the Western Samoa Aid Program for 1966-68. Banking is managed by the Bank of Western Samoa, which is owned jointly by the government of Western Samoa (45 percent) and the Bank of New Zealand (55 percent). Decimal currency was introduced in 1967 to replace the pound currency. Under the new system, the unit of currency is the Western Samoan dollar (.60 dollars equal U.S.\$1; 1973). In a recent year the national budget showed revenues of about \$6,500,000 and slightly higher expenditures.

Samoan society retains its traditional organization. The people live within an *aiga* system, which is an extended family group headed by a *matai*, or chief. The system provides security and care for those within the clan. The *aiga* system is also the liaison between the people and the modern political system. The constitution of Western Samoa provides for a parliament, consisting of a head of state and the Legislative Assembly. Parliament includes 45 Samoan members and 2 members representing the individual voters (European community). The Samoan members are elected from territorial constituencies on a franchise confined to the *matas*; the European community elects by universal suffrage. Executive power is vested in the head of state, an office held jointly by two chiefs. The judiciary is independent of both executive and legislative branches, and includes the supreme court and lower courts. The chief justice is appointed by the head of state.

Western Samoa was placed under the administration of New Zealand following World War I. Under an arrangement approved by the United

Nations, a plebiscite was held on May 9, 1961, and the people voted in favor of independence. The U.N. General Assembly voted unanimously on Oct. 18, 1961, to terminate New Zealand trusteeship. Accordingly, Western Samoa became an independent state on Jan. 1, 1962. See SAMOA. **WESTERN UNION TELEGRAPH COMPANY.** See TELEGRAPH: *Radiotelegraphy; Modern Telegraph Services.*

WESTFIELD, city of Massachusetts, in Hampden Co., on the Westfield R., 7 miles w. of Springfield. It is a railroad junction point, and maintains a municipal airport. The city is a manufacturing and distributing center of an area including about twenty other towns and comprising sections devoted to the cultivation of tobacco and garden truck. Westfield's industrial development dates from the manufacture there of whips and lashes early in the 18th century; in the 19th century Westfield was known as The Whip City. The leading industries today are the manufacture of bicycles, steel products, and paper goods. In addition, Westfield has marble and trap-rock quarries, printing plants, and a flower and shrub nursery.

The city is the site of the State College at Westfield, established in 1844, and of a State sanatorium for the treatment of tuberculosis and cancer. The Westfield Athenaeum contains museums of art and history. A trading post, called by the Indian name Woronoco, was established on the site of the present city about 1640. The settlement which developed was a part of Springfield (q.v.) until 1669, when it was incorporated separately as a town. It was chartered as a city in 1921. Pop. (1960) 26,302; (1970) 31,433.

WESTFIELD, town of New Jersey, in Union Co., 6 miles s.w. of Elizabeth and 11 miles s.w. of Newark. Principally residential, the town manufactures aircraft parts, electronic devices, machine and metal products, building materials, paint, printed matter, toys, plastic products, and food and dairy products. It is the site of the pre-Revolutionary Scudder House; Tamaques Reservation, now a park; remains of an Indian burial ground; and a Revolutionary War cemetery. Mindowaskin Park, in the center of town, was named for one of the Indians who sold the land to the first settlers in 1684. Originally called the West Fields of Elizabeth Town, the township was organized in 1794 and the town incorporated in 1903. Pop. (1960) 31,447; (1970) 33,720. **WEST GERMANY.** See GERMANY: *The Postwar Period.*

WEST HOLLYWOOD, unincorporated residential area of California, in Los Angeles Co., in

WEST INDIA COMPANY, DUTCH

the Hollywood Hills section of the Santa Monica Mts., 7 miles n.w. of downtown Los Angeles. Situated between Hollywood and Beverly Hills, the area contains the United Artists Studio. It was formerly a part of incorporated Hollywood, which merged with Los Angeles in 1910, but at that time West Hollywood reverted to the county. Pop. (1960) 28,870; (1970) 29,448.

WEST INDIA COMPANY, DUTCH. See DUTCH WEST INDIA COMPANY.

WEST INDIA COMPANY, FRENCH. See FRENCH WEST INDIA COMPANY.

WEST INDIES, in physical geography, an archipelago in the n. part of the Western Hemisphere, separating the Caribbean Sea from the Atlantic Ocean. Discovered and called the Indies by the Italian-born explorer Christopher Columbus (q.v.), it was subsequently designated the West Indies to distinguish it from the East Indies (q.v.) archipelago.

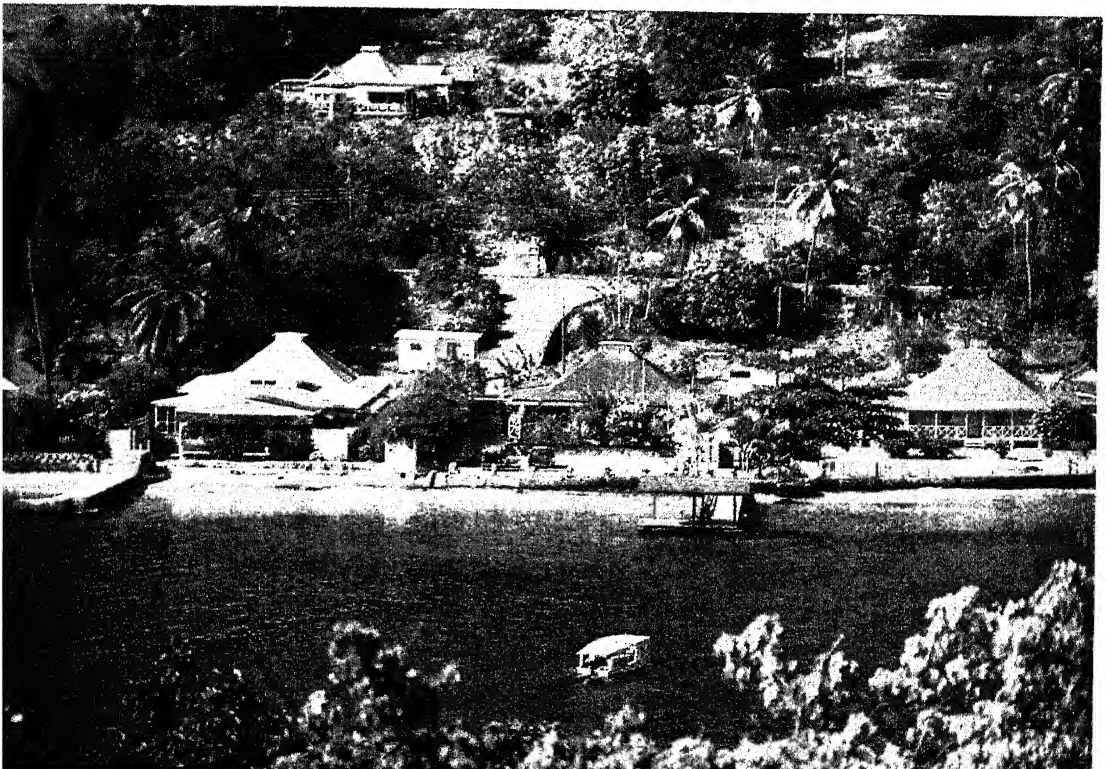
The West Indies comprises three main island chains that extend in a roughly crescent shape from the e. tip of the Yucatán Peninsula in Mexico and s.e. Florida in the United States to the Venezuelan coast of South America. The n. extremity lies at approximately lat. 27° N.; the s. extremity at about lat. 10° N. The approximate limits from e. to w. are long. 59°15' W. and long.

85° W., respectively. The Bahama Islands, in the n., form a southeasterly line. The Greater Antilles, comprising the islands of Cuba, Hispaniola, Jamaica, and Puerto Rico, lie in the center. To the s.e., arching southward from Puerto Rico and then westward along the Venezuelan coast, are the Lesser Antilles, comprising the Virgin Islands, Leeward Islands, and Windward Islands. Barbados, Trinidad, Tobago, and the Netherlands Antilles are often considered part of this third chain (see ANTILLES). The land area of the West Indies totals more than 91,000 sq.mi., and the total population in the early 1970's was about 26,000,000.

Most of the noncoral islands of the West Indies are mountainous, projecting remnants of submerged ranges related to Central and South American mountain systems. Elevations of 7000 to 8000 ft. are common in the Greater Antilles; the highest point (10,417 ft.) is Pico Duarte in the Cordillera Central of the Dominican Republic. The inner chain of the Lesser Antilles, part of a submerged volcanic ridge, consists mainly of volcanic cones, a number of which are still active: the outer chain is composed largely of coral and uplifted limestone. Elevations in the Lesser Antilles rarely exceed 5000 ft. The southernmost part of the archipelago, from Trinidad to Aruba, is geologically related to South American rock and mountain formations. The Bahamas and north-central Cuba, relatively flat lime-

A view of private vacation homes on the shore of Saint Vincent, one of the West Indies Associated States, in the Windward Islands.

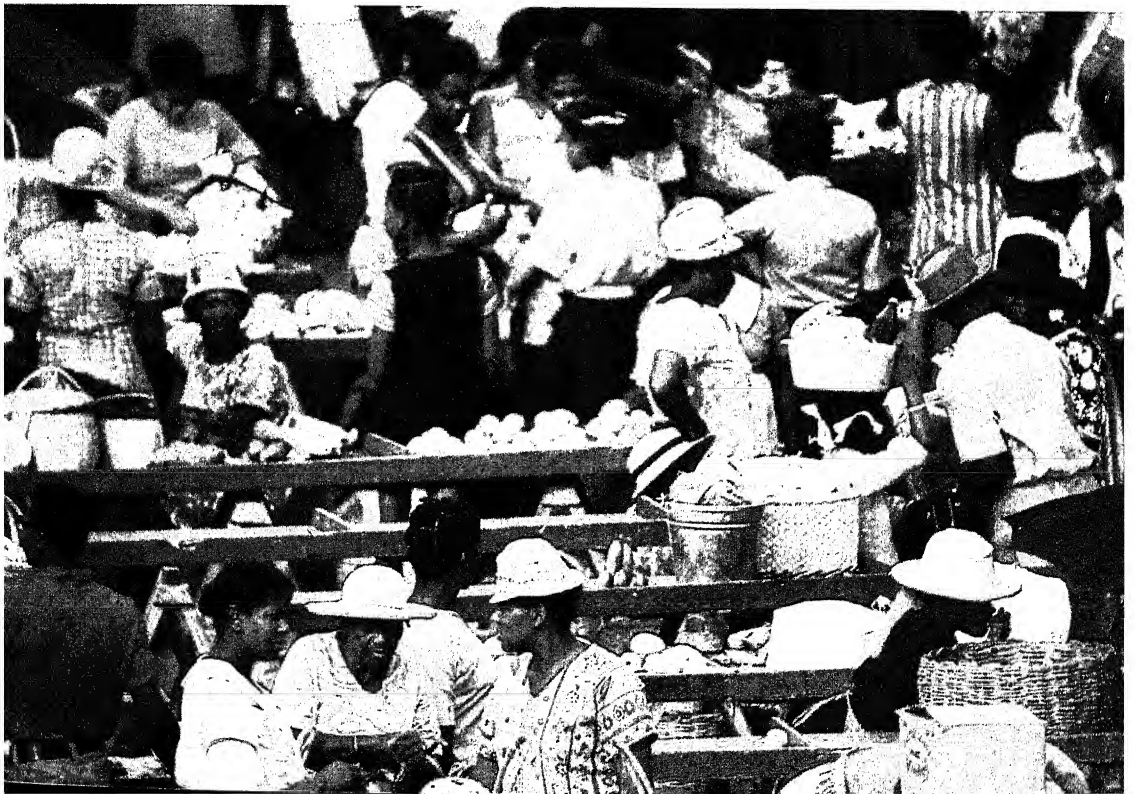
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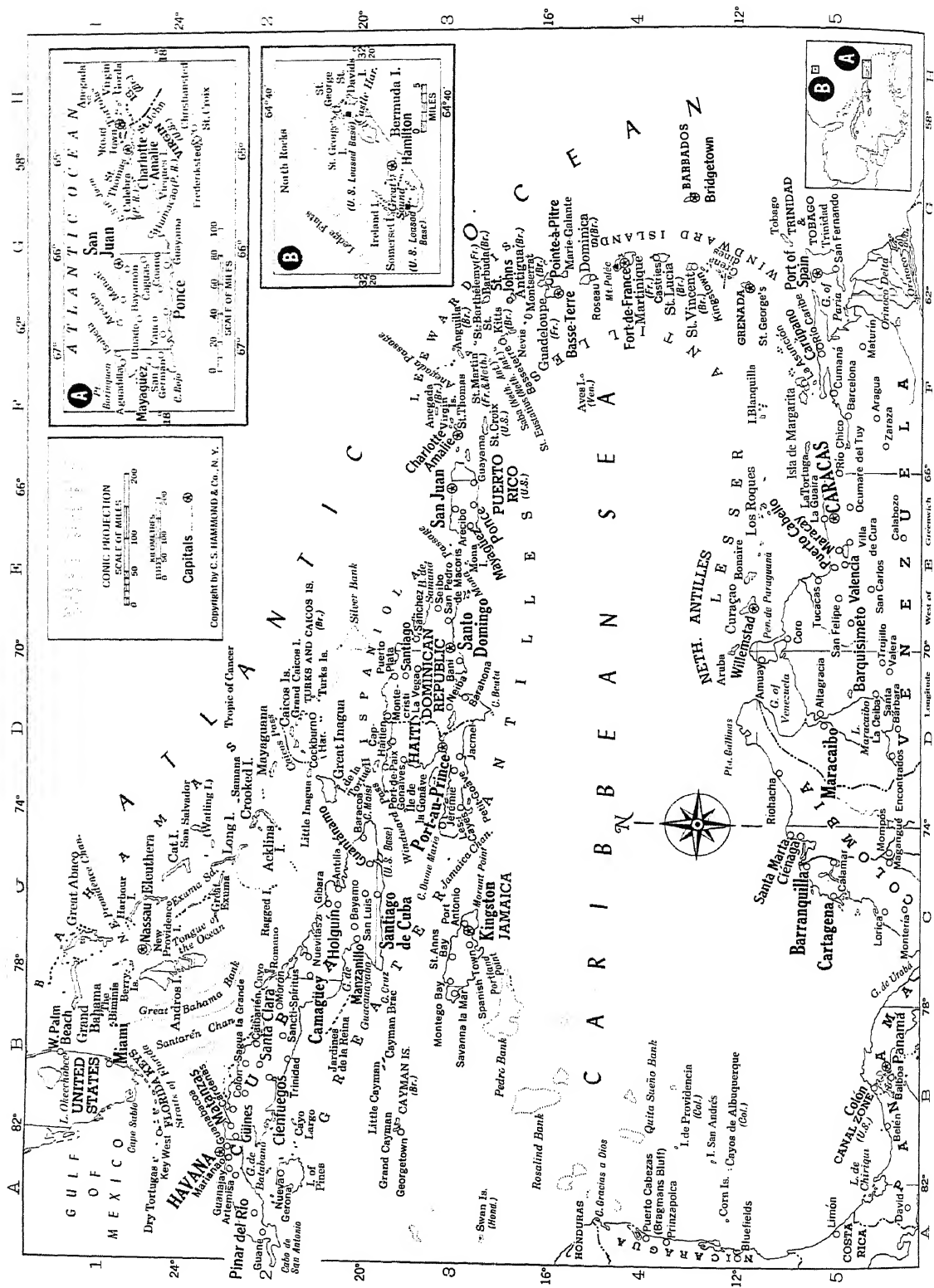




West Indies. Plate 1. Caribbean scenes. Above: The people of Port-of-Spain, principal city of Trinidad, celebrate a colorful Mardi Gras. Famed around the world for their love of song and dance, Trinidadians take credit for originating calypso music and the steel band. Below: The fruit and vegetable market in Saint George's, capital of the island of Grenada, in the Windward Islands.

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INDEX TO MAP OF WEST INDIES

Acklins (isl.), Bahamas	Caicos (isls.), Turks & Caicos Is.	Grand Caicos (isl.), Turks & Caicos Is.	Little Inagua (isl.), Bahamas	Port-de-Paix, Haiti	San Juan (cap.), Puerto Rico
Aguadilla, Puerto Rico	Caicos (pass.)	Grand Cayman (isl.), Cayman Is.	Long (isl.), Bahamas	Port of Spain (cap.), Trin. & Tobago	San Luis, Cuba
Andros (isl.), Bahamas	Camaguey, Cuba	Great Abaco (isl.), Bahamas	Los Roques (isls.), Venezuela	Portland (pt.), Jam. Puerto Plata, Dom.	San Pedro de Macoris, Dom. Rep.
Aneгада (isl.), V.I.	Cárdenas, Cuba	Great Bahama (bank), Bahamas	Manati (cape), Cuba	Rep.	San Salvador (isl.), Bahamas
Aneгада (pass.), V.I.	Castries (cap.), St. Lucia	Great Bahama (bank), Bahamas	Manzanillo, Cuba	Puerto Rico (isl.)	Sánchez, Dom. Rep.
Anguilla (isl.)	Cat (isl.), Bahamas	Great Exuma (isl.), Bahamas	Marianao, Cuba	Ragged (isl.), Bahamas	Sancti-Spiritus, Cuba
Antigua (isl.)	Cayman (isls.)	Great Inagua (isl.), Bahamas	Marie-Galante (isl.), Guadeloupe	Road Town (cap.), V.I. (Br.)	Santa Clara, Cuba
Antilla, Cuba	Cayman Brac (isl.)	Greater Antilles (isls.)	Martinique (isl.)	Rojo (cape), Puerto Rico	Santiago (chan.), Santiago de Cuba
Arrecibo, Puerto Rico	Charlotte Amalie (cap.), V.I. (U.S.)	Grenadine (isls.)	Matanzas, Cuba	Romano (cap.), Cuba	Santiago de los Caba- llos, Dom. Rep.
Artemisa, Cuba	Christiansted, V.I.	Guanayabo (gulf), Cuba	Mayagüez, Puerto Rico	Saba (isl.), Neth. Antilles	Santo Domingo (cap.), Dom. Rep.
Aruba (isl.), Neth.	Cienfuegos, Cuba	Guadalupe (isl.)	Mona (isl.), Puerto Rico	Sagua la Grande, Cuba	Savanna la Mar, Jam.
Aves (isl.), Venezuela	Coamo, Puerto Rico	Guadalupe (isl.)	Montecristi, Dom.	St. Ann's Bay, Jam.	Seibo, Dom. Rep.
Bahamas (isls.)	Cockburn Harbour, Turks & Caicos Is.	Guantanamo, Cuba	Rep.	St. Barthélemy (isl.), Guadeloupe	Spanish Town, Jam.
Bani, Dom. Rep.	Colón, Cuba	Guantanamo, Cuba	Montego Bay, Jam.	St. Croix (isl.), V.I.	Tobago (isl.), Trin. & Tobago
Baracoa, Cuba	Crooked (isl.), Bahamas	Guantanamo, Cuba	Montserrat (isl.)	St. Eustatius (isl.), Morón, Cuba	Tongue of the Ocean (chan.), Bahamas
Barahona, Dom. Rep.	Cruz (cape), Cuba	Guantanamo, Cuba	Montserrat (isl.)	St. George's (cap.), Grenada	Tortola (isl.), V.I.
Barbados (isl.)	Cuba	Guantanamo, Cuba	Montserrat (isl.)	St. John (isl.), V.I.	Tortu (isl.), Haiti
Barbuda (isl.)	Culebra (isl.), Puerto Rico	Guantanamo, Cuba	Montserrat (isl.)	St. John's (cap.), Antigua	Trinidad (isl.), Trin. & Tobago
Bassee-Terre (cap.), Guadeloupe	Curacao (isl.), Neth. Antilles	Guantanamo, Cuba	Montserrat (isl.)	St. Kitts (isl.)	Trinidad, Cuba
Basseterre (cap.), St. Kitts	Dame Marie (cape), Haiti	Guantanamo, Cuba	Montserrat (isl.)	St. Lucia (isl.)	Trinidad & Tobago
Batabanó (gulf), Cuba	Haiti	Guantanamo, Cuba	Montserrat (isl.)	St. Martin (isl.), Guadeloupe	Turks (isls.), Turks & Caicos Is.
Bayamo, Cuba	Dominica (isl.)	Guantanamo, Cuba	Montserrat (isl.)	St. Martin (isl.), Neth. Antilles	Turks & Caicos Is.
Bayamon, P.R.	Eleuthera (isl.), Bahamas	Guantanamo, Cuba	Montserrat (isl.)	St. Thomas (isl.), V.I.	Virgin Gorda (isl.), V.I.
Beata (cape), Dom. Rep.	Exuma (isl.), Bahamas	Guantanamo, Cuba	Montserrat (isl.)	St. Vincent (isl.)	Virgin Islands (Br.)
Berry (isls.), Bahamas	Exuma (sound), Bahamas	Guantanamo, Cuba	Montserrat (isl.)	Samana (bay), Dom. Rep.	Virgin Islands (U.S.)
Bimini, The (isls.), Bahamas	Fort-de-France (cap.), Martinique	Guantanamo, Cuba	Montserrat (isl.)	San Antonio (cape), Cuba	Watling (San Salvador), (isl.), Bahamas
Blanca (isl.), Venezuela	Frederiksted, V.I.	Guantanamo, Cuba	Montserrat (isl.)	San Fernando, Trin. & Tobago	Willemstad (cap.), (isl.), Bahamas
Blanquilla (isl.), Venezuela	Georgetown (cap.), Guyana	Guantanamo, Cuba	Montserrat (isl.)	Port Antonio, Jam.	Windward (isls.), Windward (pass.)
Bonaire (isl.), Neth. Antilles	Gibara, Cuba	Guantanamo, Cuba	Montserrat (isl.)	Port-au-Prince (cap.), Haiti	Yauco, Puerto Rico
Borinquen (pt.), Puerto Rico	Gonâve (isl.), Haiti	Guantanamo, Cuba	Montserrat (isl.)		
Bridgetown (cap.), Barbados	Grand Bahama (isl.), Bahama Is.	Guantanamo, Cuba	Montserrat (isl.)		
Caguas, Puerto Rico		Guantanamo, Cuba	Montserrat (isl.)		
Caibarien, Cuba		Guantanamo, Cuba	Montserrat (isl.)		



A beach on Saint Lucia, one of the Windward Islands. In the background (right) rises the picturesque cone of Grand Piton Mountain.

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stone and coral formations, are geologically related to formations in Florida and the Yucatán Peninsula. Several deep ocean trenches lie close offshore and parallel to the islands of the Greater and Lesser Antilles, marking unstable crustal zones in which earthquakes may occur.

Climate. Except for part of the Bahamas chain, all the West Indies islands lie within the Tropic Zone, but temperate climatic conditions exist in many mountainous regions; and weather conditions at lower elevations are modified by such oceanic influences as the trade winds. Two seasons are distinguishable: a relatively dry season, from November through May; and a wet season, from June through October. Northeastern winds prevail during the wet season, and southeastern winds during the dry season. Hurricanes, formed in the Atlantic, may occur between July and October, destroying much life and property when they sweep onshore. Temperatures throughout the coastal regions of the archipelago seldom fall below 70° F. in the coolest months, January and February; the average is about 80°–85° during July and August. Precipitation averages some 65 in. annually. Below-average temperatures are common, however, in high mountainous areas, and sharp variations in average precipitation are recorded on the mountain slopes.

Plants and Animals. Indigenous plants are tropical and subtropical. Many islands contain dense forests, and various species of valuable timber and fruit trees are found. Numerous species of imported plant life, particularly grains, vegetables, and other varieties native to the Temperate Zone, flourish in the archipelago because of the diversified climate. Large mammals are not found among native animals. Of the smaller mammals, the armadillo, raccoon, opossum, monkey, and agouti are typical. Snakes, especially adders and boas, and various lizards are plentiful in the archipelago. Tropical and subtropical birds, such as the parrot, trogon, and many waterfowl, are abundant.

People. No indigenous people remain in the West Indies; the pre-Columbian Indian population was either killed or assimilated quite early. Thus, the present-day population is largely of European and African descent. See ARAWAKAN; CARIB.

Political Divisions. Politically, the West Indies comprises seven independent nations and a number of colonial dependencies, territories, and possessions. The Republic of Cuba, consisting of the island of Cuba and several off-lying islands, is the largest West Indies nation. Haiti and the Dominican Republic, two other independent nations, occupy Hispaniola, the second-largest island of the archipelago. Jamaica, Barbados, the Bahamas, and Trinidad and Tobago are the other sovereign nations.



Montserrat Tourist Board

West Indies. Plate 2. Above: A serene landscape looking toward the bay, on the mountainous Leeward Island of Montserrat, British West Indies. Below, left: A rural scene on the Leeward Island of Saint Eustatius, Netherlands Antilles. Below, right: A tourist hotel in the Condado Beach area of San Juan, capital and chief city of Puerto Rico.

Caribbean Tourist Board

Harvey Stein





Caribbean Tourist Board

West Indies. Plate 3. Top: A steel band performs for visitors on the island of Aruba, Netherlands Antilles. Center: Handlers set their birds to a cockfight, a popular sport with Haitians, who breed and train gamecocks for fighting. Bottom: Idyllic scenes such as this in the Port Antonio area make rafting a strong tourist attraction in Jamaica.



Caribbean Tourist Board

Bryna C. Mande



WESTINGHOUSE ELECTRIC CORPORATION

Sovereignty over nearly all of the other West Indies islands is distributed among the U.S., France, the Netherlands, and Great Britain. Puerto Rico, fourth-largest island of the archipelago, is a Commonwealth of the U.S.; and several of the Virgin Islands are U.S. territories (see VIRGIN ISLANDS OF THE UNITED STATES). The French West Indies includes Martinique, Guadeloupe, and a number of small-island dependencies of Guadeloupe. The Dutch possessions consist of Curaçao, Bonaire, Aruba, and three smaller Lesser Antilles Islands; see NETHERLANDS ANTILLES. Venezuela holds seventy-two Lesser Antilles islands (total area, 14,633 sq.mi.). Dependencies of Great Britain are the Cayman Islands, Turks and Caicos Islands (q.v.), some islands of the Windward group, and some of the Virgin Islands (see VIRGIN ISLANDS, BRITISH; WEST INDIES, THE). The West Indies Associated States, in free association with Great Britain, comprise Antigua, Dominica, Saint Kitts-Nevis, Saint Lucia, and Saint Vincent.

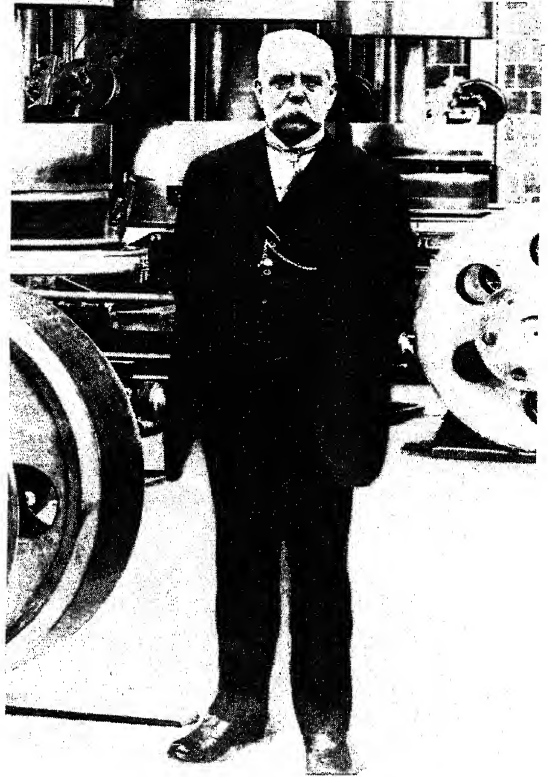
For additional data on the archipelago, see articles on the various islands and island groups. **WEST INDIES, THE**, former federation of British dependencies in the West Indies (q.v.). Created officially in 1958, it comprised ten members: Antigua, Barbados, Dominica, Grenada, Jamaica, Montserrat, Saint Kitts-Nevis-Anguilla, Saint Lucia, Saint Vincent, and Trinidad and Tobago. Attainment of dominion status, and thereby greater independence within the Commonwealth of Nations (q.v.), was the principal goal. The Cayman, Turks, and Caicos islands were also included in the federation as dependencies of Jamaica; but all three island groups became separate British dependencies, the first in 1959 and the last two in 1960. Secession in 1962 by Jamaica, then Trinidad and Tobago, caused the formal dissolution of the federation. Subsequently, Jamaica (1962), Trinidad and Tobago (1962), and Barbados (1966) achieved independence. In 1967 all the still dependent original members of the federation except Montserrat formed the West Indies Associated States in free association with Great Britain, allowing the island governments control over their internal affairs.

WEST INDIES, NETHERLANDS. See NETHERLANDS ANTILLES.

WESTINGHOUSE, George (1846–1914), American inventor, engineer, and industrialist, born in Central Bridge, N.Y., and educated at what is now Union College and University at Schenectady, N.Y. His first important invention, developed while he was employed in his father's factory in Schenectady, was a railway frog,

a device permitting trains to cross from one track to another. He devised his most famous invention, the air brake (see BRAKE), about 1868. Although successfully demonstrated in 1868, the air brake did not become standard equipment until after the passage of the Railroad Safety Appliance Act in 1893.

Westinghouse invented many other safety de-



George Westinghouse

Westinghouse

vices, especially for automatic railway signaling; developed a system for transporting natural gas; and acquired more than 400 patents, including many for alternating-current machinery; see ELECTRIC HOME APPLIANCES. He pioneered in the use of alternating-current power in the United States; see ELECTRICITY: *Alternating Currents*.

WESTINGHOUSE ELECTRIC CORPORATION, corporate descendant of the Westinghouse Electric Company organized by George Westinghouse (q.v.) in 1886 to produce transformers for transmission of alternating-current electricity. It is today a leading manufacturer of electrical power systems, nuclear reactors, and related machinery; a producer of electronic components and electrical equipment for industry.

Westinghouse pioneered in the manufacture of airborne radar (q.v.) systems. It designed and

WEST IRIAN

built the first industrial atom smasher (1936), the atomic reactor for the first nuclear-powered naval vessel built in the United States (1954), and the television cameras that transmitted to earth a record of the first astronauts on the moon (1969). The corporation also owns and operates the "Group W" radio and television stations, including KDKA in Pittsburgh (which made the first scheduled radio broadcast in 1920), and produces popular television programs for syndication. In 1970 Westinghouse employed about 145,000 persons and had more than 160,000 shareholders. Corporate headquarters is in Pittsburgh.

WEST IRIAN. See INDONESIA, REPUBLIC OF.

WEST LAFAYETTE, city of Indiana, in Tipton Co., on the Wabash R., about 56 miles N.W. of Indianapolis. Primarily residential, the city has some manufacturing of metal products. In nearby Lafayette is Purdue University (q.v.), which was founded in 1865. West Lafayette was incorporated in 1924. Pop. (1970) 19,157.

WESTLAKE, city of Ohio, in Cuyahoga Co., a suburb about 12 miles W. of central Cleveland.

Manufactures include plastics and chemicals. The city was formerly known as Dover or Dover Center. Westlake was incorporated in 1911. Pop. (1960) 12,902; (1970) 15,689.

WEST LOTHIAN, Great Britain, formerly LINLITHGOWSHIRE, county of S.E. Scotland, bounded on the N. by the Firth of Forth, on the E. and S. by Midlothian County, and on the W. by Lanark and Stirling counties. The terrain is hilly in the S. and slopes from the interior to the firth. The principal rivers are the Almond and the Avon, and the county is crossed in a S.E. to N.W. direction by the Union Canal, which connects Edinburgh, in Midlothian County, to the Firth and Clyde Canal. Agriculture is the chief industry, and approximately two thirds of the area of the county is under cultivation. The chief crops are oats, barley, and wheat. Dairy farming is also important. Minerals found in West Lothian include coal, silver, oil shale, clay, limestone, free-stone, and whinstone. Manufactures include steel, iron, paper, hosiery, and alcoholic beverages. Linlithgow is the county seat. Other towns include Bathgate, Bo'ness, and Queensferry. Among the many Roman remains of the county is a section of the Wall of Antoninus. The area of the county is approximately 120 sq.mi. Pop. (1971) 108,481.

The east end of the nave of Westminster Abbey, with the 19th-century choir screen in the middle distance. Close by are the graves of Charles Darwin, Lord Kelvin, and other scientists.

Alan Bond Associates



WESTMEATH, county of the Republic of Ireland, in Leinster Province, in the fertile central plains region of the island. The principal rivers are the Shannon and the Brosna and there are numerous lakes (loughs), the largest of which is Lough Ree. Agriculture is the chief occupation of the inhabitants; stock raising, dairying, and potato farming are other important enterprises. There are limestone quarries and factories that are engaged in the manufacture of textiles, most notably wool tweed and cotton and linen goods. Mullingar is the county seat and the largest town is Athlone. Westmeath was constituted a county in 1543. Area, 681 sq.mi.; pop. (1971) 53,570.

WEST MEMPHIS, city of Arkansas, in Crittenden Co., on the Mississippi R., 8 miles w. of Memphis, Tenn. The trade center of a region growing rice, cotton, corn, soybeans, and alfalfa, the city is linked with Memphis by the Memphis-Arkansas bridge. Local industries include soybean and cottonseed-oil processing, cotton ginning, sawmilling, food processing and canning, meat packing, distilling, and the manufacture of steel and concrete products, industrial equipment, wooden caskets, and fertilizer. Founded about 1910 as the logging camp of Bragg's Spur, the community was incorporated in the 1920's and became a city in 1935. Pop. (1960) 19,374; (1970) 25,892.

WEST MIFFLIN, borough in Pennsylvania, in Allegheny Co., on the Monongahela R., adjoining Pittsburgh, 8 miles s.e. of the city center. The borough has food-processing and atomic-energy plants and manufactures steel and coal products, metal products, auto bodies, prefabricated houses, and chemicals. It is the site of the Allegheny County Airport and Kennywood Amusement Park, one of the largest in the United States. Mifflin Township was created in 1788, and the borough was incorporated in 1944. The post office was formerly called Terrace. Pop. (1960) 27,289; (1970) 28,070.

WESTMINSTER, city of California, in Orange Co., 10 miles E. of Long Beach. Lying in an area of dairy and truck farms and citrus groves, the city manufactures food products, camping trailers, tubing, concrete, and tile. When Westminster was incorporated in 1957, Barber City, the western section, was included. Pop. (1960) 25,750; (1970) 59,865.

WESTMINSTER, city of Colorado, in Adams Co., a suburb about 9 miles N. of Denver. Primarily residential, the city has some manufacturing of wood products. Westminster was incorporated as a city in 1911. Pop. (1960) 13,850; (1970) 19,432.

WESTMINSTER, officially CITY OF WESTMINSTER, Great Britain, borough of London, England, on the N. bank of the Thames R. and W. of the city of London. Westminster includes, since 1965, the former boroughs of Saint Marylebone and Paddington. Royal and official London is centered in Westminster, which is the site of the Houses of Parliament, many government buildings, Westminster Abbey, Saint James's Palace, and Buckingham Palace. Some other notable landmarks in the city are Saint James's and Green parks, as well as Hyde Park; Piccadilly, Trafalgar, Leicester, and Belgrave squares; such major art museums as the Tate and the National galleries; Madame Tussaud's wax museum; Covent Garden; and Charing Cross, Victoria, Marylebone, and Paddington railway stations. Pop. (1971) 239,748.

WESTMINSTER ABBEY, officially, THE COLLEGIATE CHURCH OF SAINT PETER IN WESTMINSTER, national sanctuary and burial place in the borough of Westminster, London, England. The first church on the site is said to have been built about 616 by the first Christian king of the East Saxons, Sebert (fl. 7th cent.), who dedicated it to Saint Peter. The Saxon king Edward the Confessor, who had a palace at Westminster, built a church on the present site between 1049 and 1065. In the 13th century the English king Henry III undertook the reconstruction of the church. The choir and transepts were built between 1245 and 1258, and, with the eastern half of the nave, consecrated in 1269. A new nave was built in the 14th and 15th centuries. Henry VII's chapel, begun in 1502 by the English king Henry VII as a Lady chapel, was completed as his mausoleum chapel by his successor, Henry VIII, in 1520. The two west towers were designed by the English architect Sir Christopher Wren and his pupil Nicholas Hawksmoor (1661-1736) and completed about 1750. The Abbey and several of the surrounding buildings, which include the cloisters, a chapter house, the Chapel of the Pyx, and the Abbey library and museum, were slightly damaged in various air raids during World War II. An extensive program of repairs, which was begun in 1954, was finally completed in 1965.

Westminster Abbey is one of the largest and best examples of the early English architectural style. It shows French influences in the polygonal apse and chapels, in the loftiness of the nave, and in the heavy flying buttresses. The floor plan is in the form of a Latin cross, and the overall proportions of the Abbey are grandiose. The total exterior length, including Henry VII's chapel, is 531 ft.; the breadth is 72 ft. for nave

WESTMINSTER PALACE

and aisles, and 203 ft. across the transepts. The nave is almost 102 ft. high, and the towers, 225 ft. The famous Jerusalem Chamber, to the southwest of the abbey, is so called because it was once hung with tapestries depicting the Holy City. Henry VII's chapel is a remarkable structure in the Perpendicular (q.v.) style, and has a ceiling vaulted with fan tracery. See **GOthic ARCHITECTURE**.

Of all English churches none is so intimately connected with national life and history. Every English monarch since William I, with the exception of Edward V and Edward VIII, has been crowned in the Abbey. The coronation chair, containing the ancient Stone of Scone (see **SCONE**), brought by the English king Edward I from Scotland, still stands in the chapel of Edward the Confessor.

Memorials. In Westminster Abbey thirteen kings lie buried, including Edward the Confessor and others from Henry III to George II; five sovereign queens; and many consorts and descendants of kings. The practice of interring courtiers, statesmen, and soldiers in the abbey began under King Richard II in the 14th century. The two William Pitts, Henry John Temple Palmerston, William Ewart Gladstone, and numerous other British statesmen have been accorded this honor. In the Poets' Corner (south transept) repose some of England's greatest poets, notably Geoffrey Chaucer, Edmund Spenser, John Dryden, Thomas Gray, Alfred Tennyson, and Robert Browning; and nearby rest the men of letters. The tomb of the "Unknown Warrior" of World War I is in the center of the nave. A memorial chapel to those who died in the Battle of Britain (see **WORLD WAR II**) was dedicated in 1947.

See separate articles for those persons noted above whose birth and death dates are not given.

WESTMINSTER PALACE. See **PARLIAMENT, HOUSES OF**.

WESTMINSTER, STATUTE OF, enactment of the British Parliament, in December, 1931, recognizing the full equality of the British dominions with the United Kingdom of Great Britain and Northern Ireland and establishing the Commonwealth of Nations, an association of independent states. According to the statute, the United Kingdom and the "Dominions are autonomous communities within the British Empire, equal in status, in no way subordinate one to another in any aspect of their domestic or external affairs, though united by a common allegiance to the Crown, and freely associated as members of the British Commonwealth of Na-

tions". By the provisions of the statute, the dominions are empowered to reject any law of the British Parliament if their own parliaments so decide and to enact legislation concerning all domestic matters, including merchant shipping.

WEST MONROE, city of Louisiana, in Ouachita Parish, on the Ouachita R., about 2 miles w. of Monroe. Manufactures include paper and wood products, chemicals, and clothing. A natural gas field is situated there. Founded about 1860, the city was incorporated in 1926. Pop. (1960) 15,215; (1970) 14,868.

WEST NEW YORK, town of New Jersey, in Hudson Co., on the Hudson R., opposite New York City, and adjoining Weehawken. Water-front facilities include docks and grain elevators. The leading industrial establishments of the town are engaged in the manufacture of embroideries, textiles, rubber goods, and smoking pipes and accessories. West New York was settled in 1790 and incorporated as a town in 1898. Pop. (1960) 35,547; (1970) 40,627.

WEST ORANGE. See **ORANGES, THE**.

WEST PALM BEACH, city in Florida, and county seat of Palm Beach Co., on Lake Worth, about 70 miles n. of Miami. Noted as a winter resort, it is also a port of entry and the commercial center of Palm Beach, with which it is linked by bridge and ferry. Fishing is an important industry, and there are factories engaged in the manufacture of building materials, data-processing systems, electronic equipment, and paints and varnishes. Points of interest include the Norton Gallery and School of Art, the Marine Museum, and a nearby alligator and ostrich farm. West Palm Beach was founded in the 1880's and incorporated as a city in 1894. Pop. (1960) 56,208; (1970) 57,290.

WESTPHALIA, former Prussian province, now a part of the West German State of North Rhine-Westphalia. It was bounded by the Netherlands on the n.w., the former Prussian provinces of Hannover on the n. and e., Hesse-Nassau on the s.e. and s., and the Rhine Province on the s.w. and w. About 1180 Westphalia came under the archbishops of Cologne, as dukes of Westphalia. In 1807 Westphalia, with parts of Hesse, Hannover, Brunswick, and Saxony, was made into a kingdom by the French emperor Napoleon I (q.v.) and given to his youngest brother Jérôme Bonaparte (see **under BONAPARTE**); it was incorporated in the Confederation of the Rhine. In 1813, following Napoleon's military reverses, the kingdom was dissolved, and the Congress of Vienna (see **VIENNA, CONGRESS OF**) assigned Westphalia to Prussia (q.v.). The Peace of Westphalia concluded at Münster and Osnabrück, Oct. 24,

1648, brought the Thirty Years' War (q.v.) to an end; see **WESTPHALIA, PEACE OF**. Area of former province, 7806 sq.mi.

WESTPHALIA, PEACE OF, treaty, signed Oct. 24, 1648, that closed the Thirty Years' War (q.v.) and readjusted the religious and political affairs of Europe. It is so called because the negotiations, which began in 1644, took place in the German cities of Münster and Osnabrück, in Westphalia. The main participants were France and Sweden and their opponents Spain and the Holy Roman Empire. By the terms of the treaty, the sovereignty and independence of the different states of the Holy Roman Empire (q.v.) were fully recognized, making the Holy Roman emperor virtually powerless.

Among the territorial provisions of the treaty were the following: France was confirmed in the possession of the city of Pinerolo in Piedmont and the bishoprics of Metz, Toul, and Verdun in Lorraine. Also, the town of Breisach on the east bank of the Rhine R. and most of Alsace were ceded to France. Sweden obtained western Pomerania, with Stettin, Wismar, and the islands of Rügen and Poel, thus gaining control of the Baltic Sea. The archbishopric of Bremen and the bishopric of Verden were also ceded to Sweden, and both Sweden and France obtained the right to vote in the diet of the Holy Roman Empire. Brandenburg obtained, as compensation for its cessions in Pomerania, Cammin and the bishoprics of Halberstadt and Minden, together with succession to the archbishopric of Magdeburg. Mecklenburg-Schwerin was enlarged by the bishoprics of Schwerin and Ratzeburg in compensation for Wismar. Hesse-Kassel obtained the rich abbacy of Hersfeld, and Saxony was allowed to retain Lusatia. The Lower Palatinate was restored to Charles Louis (1617–80), eldest son of the elector of the Palatinate Frederick V (1596–1632), and an eighth electorate was created in his favor; the Upper Palatinate was confirmed to Bavaria; see **PALATINATE**. Also, the de facto independence of Switzerland and of the United Provinces of the Netherlands was recognized. The overall result of this political reorganization was that France, mainly at the expense of the Austrian Hapsburgs, emerged as the chief power on the Continent; see **HAPSBURG**.

The provisions with respect to ecclesiastical affairs included the interdiction of all religious persecution in Germany and the confirmation of the Treaty of Passau (1552; see **SCHMALKALDIC LEAGUE**) and the religious Peace of Augsburg (1555; see **AUGSBURG**). Also, the Calvinist Protestants were granted the privileges enjoyed by the Lutherans. On the other hand, if a prince

changed his religion he would forfeit his lands; this provision was included as a method of checking the spread of the Reformation (q.v.). The Peace of Westphalia marked the close of the period of religious wars. Thereafter, European armed struggles were waged principally for political ends.

See also **EUROPE: History: Medieval: Trade and the Renaissance**; and sections on *History* in various separate articles on major countries mentioned.

WEST POINT, United States military reservation in New York, in Orange Co., on the w. bank of the Hudson R., about 50 miles N. of New York City. It lies in a scenic area, s.e. of Storm King Mt., and is the site of the United States Military Academy (q.v.). The reservation, which covers about 15,000 acres, also includes Constitution Island (about $\frac{3}{4}$ mi. wide) in the Hudson.

Troops of the Continental Army occupied the area in January, 1778, during the American Revolution (q.v.). As the key to the defense of the Hudson R. valley, it was strongly fortified by the Americans; an iron chain was laid across the river between West Point and Constitution Island to prevent British vessels from proceeding up the river. In 1780 the American commander, Brigadier General Benedict Arnold (q.v.), attempted to betray the post to the British, but his plan was upset by the capture of Major John André (q.v.). West Point became U.S. government property in 1790, and the Military Academy was established there in 1802.

WESTPORT, town of Connecticut, in Fairfield Co., on Long Island Sound, at the mouth of the Saugatuck R., adjoining Norwalk on the E. Although the town is principally a residential resort, it manufactures chemicals, office furniture, hardboard, embalming fluid, cordage, plastic products, toys, soap and cleansers, and cable devices. The surrounding rural areas raise fruit, truck-farm products, and poultry. The town includes Sherwood Island State Park, with beach facilities; a summer theater; an artists' and writers' colony; the Music Hill amphitheater; and Compo Beach and yacht basin. The villages of Saugatuck and Greens Farms are within the town; the latter was originally the Indian town of Machamux. Settled in the 1640's, the town was a colonial port and was formerly known as Saugatuck. It was incorporated in 1835. Pop. (1960) 20,955; (1970) 27,414.

WEST RIDING. See **YORKSHIRE**.

WEST SAINT PAUL, city of Minnesota, in Dakota Co., near the s. bank of the Mississippi R., a suburb about 3 miles s. of Saint Paul. Primarily residential, the city has some manufacturing.

WEST SENECA

West Saint Paul was settled in 1848, and incorporated in 1858. Pop. (1960) 13,101; (1970) 18,799.

WEST SENECA, unincorporated community of New York, in Erie Co., on Buffalo and Cazenovia creeks, adjoining Buffalo and 6 miles S.E. of the city center. It is largely residential but manufactures metal products and batteries. Pop. (1960) 33,644; (1970) 48,404.

WEST SPRINGFIELD. See SPRINGFIELD, MASS.

WEST VIRGINIA, one of the South Atlantic States of the United States, bounded on the N. by Ohio, Pennsylvania, and Maryland; on the E. by Virginia and Maryland; on the S. by Virginia and Kentucky, and on the W. by Kentucky and Ohio. Generally oval in shape, West Virginia measures about 275 mi. from E. to W. and about 245 mi. from N. to S. Two narrow tongues of land, or panhandles, extend northward between Pennsylvania and Ohio and eastward between Maryland and Virginia, respectively.

Area (41st State in rank)	24,181 sq. mi.
Land	24,070 sq. mi.
Inland water	111 sq. mi.
Population	(1970, 34th in rank) 1,744,237
	(1960, 30th in rank) 1,860,491
	(1950) 2,005,552
Altitude	240 ft. to 4,862 ft.
Capital and largest city	Charleston (1970) 71,505
Entered Union (35th State)	June 20, 1863
Nickname	The Mountain State
Motto	Montani Semper Liberi (Mountaineers Are Always Free)
Song	"The West Virginia Hills"
Tree	sugar maple
Flower	big rhododendron
Bird	cardinal

THE LAND

The surface of West Virginia is generally rugged; the E. section, particularly, is mountainous. The main range of the Allegheny Mts. crosses the N.E. section and farther S. forms the State boundary with Virginia. The greater part of the mountain region, occupying more than one third of the State, belongs to the Allegheny Plateau; the mountains in the extreme S. are a N. extension of the Cumberland Plateau. The mountains of the N.E. are chiefly in the form of parallel ridges trending S.W. to N.E.; the S. mountains are irregularly dissected by river valleys, presenting broad domes with spurs running in all directions but few definite ridges. The elevation of the valleys is about 2000 ft., the elevation of the ridges from 3000 to more than 4000 ft. The highest point in the State is Spruce Knob (4862 ft.) in Pendleton County; the average elevation is 1500 ft., highest of any State E. of the Mississippi R. West of the mountains is a belt of broad, flat hills from 1000 to 2000 ft. in elevation, followed by a more gently rolling country that slopes toward the Ohio R.

Rivers and Lakes. With the exception of the N.E. section, the entire State is drained by the Ohio R. and its tributaries. The largest of the tributaries are the Big Sandy, Guyandotte, Kanawha, and Little Kanawha rivers and the headstreams of the Monongahela. The extreme N.E. section of West Virginia is drained by the Potomac R. and its tributaries. West Virginia has a number of artificial lakes, among them Cheat Lake on the Cheat R., Tygart Lake on the Tygart Valley R., Bluestone Lake on the New R., Summersville Reservoir on the Cherry R., and Sutton Lake on the Elk R.

Climate. West Virginia has moderately severe winters, longer and colder in the mountains, with frequent alternation of fair and stormy weather. Summers are hot and showery. The highest temperature recorded in the State was 112° F. (at Martinsburg); the lowest, -37° F. (at Lewisburg). Precipitation is greatest in the central part of the State, ranging up to 50 in. annually, and decreases to the W. and E. Snowfall exhibits the same pattern to a more marked degree; totals of 115 in. are recorded in the central mountains. The average annual number of days with measurable precipitation ranges from 128 at Huntington to 143 at Parkersburg, 148 at Charleston, and 164 at Elkins. Thunderstorms are common, mostly in summer and in the mountains, and occasionally are accompanied by hail. Tornadoes are rare, and tropical storms seldom strike the State with full force.

Climate	Charleston	Elkins	Huntington
Normal temperatures (in ° F.)			
January maximum	43.6	40.7	42.9
January minimum	25.3	19.2	25.6
July maximum	85.6	80.3	85.7
July minimum	64.3	57.1	64.8
Annual	55.2	49.6	55.2
Normal precipitation (in inches)			
Wettest month	5.04	4.94	4.19
Driest month	2.45	2.71	2.09
Annual	40.75	43.22	38.88
Latest frost	April 18	May 10	April 14
Earliest frost	Oct. 28	Oct. 7	Oct. 27
Mean number of days between latest and earliest frosts	193	150	196

Plants and Animals. At one time West Virginia was covered almost completely by forest. About two thirds of the State is still forested, although very little virgin forest remains. White pine, hemlock, and spruce predominate in the higher altitudes; hardwoods grow on the lower slopes. Several species of oak are the commonest hardwoods, followed by hickories, black walnut, poplars, sycamore, ashes, beeches, maples, cherries, and elms. Rhododendron, laurel, azalea, and wisteria are abundant throughout the State. Several formerly common animal spe-

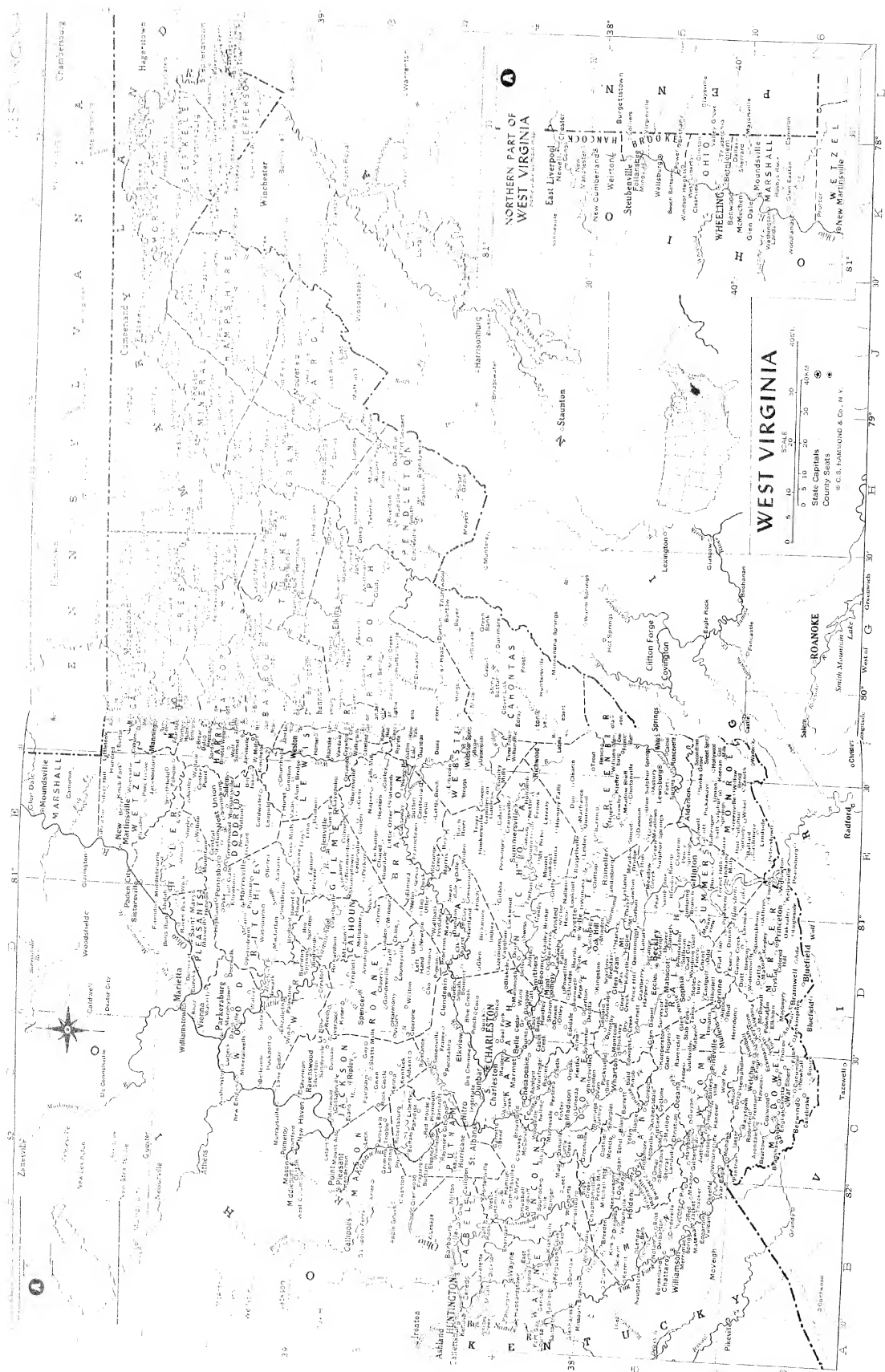
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Arles ..	5	Camp Creek ..	D 5	Edgerton ..	B 5	Hamlin ..	B 4
Arnett ..	5	Canebrake ..	C 6	Elbert ..	C 6	Hampden ..	C 5
Arthur ..	1	Canas ..	E 4	Eleanor ..	C 3	Handley ..	D 4
Arthurdale ..	5	Capon Bridge ..	K 2	Elizabeth ..	D 3	Hanover ..	C 5
Asbury ..	5	Capon Springs ..	K 2	Elk Garden ..	D 3	Harding ..	G 3
Asco ..	4	Carbon ..	D 4	Elkins ..	I 2	Harper ..	D 5
Ashford ..	4	Caretta ..	C 6	Elkins ..	I 2	Harpers Ferry ..	D 2
Ashton ..	3	Cassville ..	F 1	Elkridge ..	C 4	Harrisville ..	C 2
Athens ..	6	Catawba ..	F 1	Elkview ..	C 4	Hartford ..	C 2
Augusta ..	6	Cedar Grove ..	D 4	Elmore ..	D 3	Harvey ..	D 5
Aurora ..	6	Central Station ..	E 2	Ellenboro ..	D 5	Havaco ..	C 6
Avondale ..	6	Century ..	F 2	Elton ..	C 5	Heaters ..	F 3
Baileysville ..	5	Ceredo ..	B 4	English ..	C 6	Hedgesville ..	K 1
Baisden ..	5	Chapmanville ..	B 5	Enterprise ..	F 2	Helvetia ..	F 3
Baker ..	2	Charleston (cap) ..	C 4	Erbacon ..	C 3	Hemphill ..	C 6
Bakerton ..	2	Charles Town ..	E 2	Eskdale ..	D 4	Henderson ..	B 3
Bald Knob ..	5	Charmco ..	E 4	Ethel ..	C 5	Hendricks ..	G 2
Ballard ..	6	Chattahoo ..	B 5	Eureka ..	D 2	Henlawson ..	B 5
Bancroft ..	3	Chesapeake ..	C 4	Evans ..	C 3	Hepzibah ..	F 2
Barboursville ..	4	Chester ..	F 4	Everettville ..	F 1	Herndon ..	D 5
Barnabus ..	5	Cinco ..	D 4	Fairmont ..	C 3	Hico ..	D 4
Barrackville ..	1	Circleville ..	H 3	Fairview ..	F 1	Hillsboro ..	F 4
Barrett ..	6	Clarksburg ..	F 2	Farmington ..	F 1	Hinton ..	F 5
Bartley ..	1	Clay ..	D 4	Fayetteville ..	D 4	Holcomb ..	F 4
Bath ..	2	Clear Creek ..	D 5	Fenwick ..	D 4	Holden ..	B 5
Beards Fork ..	4	Clearview ..	K 5	Ferrellsburg ..	D 4	Hookersville ..	F 4
Beartown ..	6	Clemonin ..	D 3	Ferro ..	D 5	Hundred ..	F 1
Beaver ..	5	Clyde ..	F 4	Fisher ..	H 3	Huntington ..	A 4
Beckley ..	5	Cinton ..	K 5	Flat Top ..	D 5	Hurricane ..	C 4
Beech Bottom ..	5	Clio ..	D 3	Flatwoods ..	F 3	Jaeger ..	C 6
Beeson ..	6	Clothier ..	C 5	Flemington ..	F 3	Indore ..	C 4
Belington ..	2	Clover ..	D 3	Follansbee ..	K 5	Institute ..	C 4
Belle ..	4	Clover Lick ..	F 4	Folsom ..	C 2	Inwood ..	K 2
Belmont ..	2	Coal City ..	D 5	Forest Hill ..	F 5	Irmann ..	D 5
Belva ..	4	Coal Fork ..	D 4	Fort Ashby ..	J 2	Ivydale ..	D 3
Benwood ..	5	Coalton ..	G 3	Fort Gay ..	A 4	Jacksonburg ..	F 1
Bergoo ..	4	Coalwood ..	C 6	Fort Seybert ..	H 3	Jane Lew ..	F 2
Berkeley ..	2	Coburn ..	F 1	Fort Spring ..	F 5	Jarvisville ..	F 2
Berkeley Springs ..	1	Colcord ..	D 5	Four States ..	F 5	Jeffrey ..	C 5
Berwind ..	6	Colliers ..	F 5	Frame ..	C 3	Jenkinjones ..	D 6
Bethany ..	5	Colored Hill ..	D 6	Frametown ..	F 3	Jodie ..	D 4
Bethlehem ..	5	Copen ..	E 3	Frankford ..	F 3	Jumping Branch ..	F 5
Beverly ..	5	Conne ..	D 5	Franklin ..	I 3	Junior ..	C 5
Bickmore ..	4	Conth ..	H 2	French Creek ..	F 3	Justice ..	F 2
Big Chimney ..	4	Costa ..	C 4	Frenchton ..	D 3	Kearneysville ..	F 2
Big Creek ..	5	Cottageville ..	C 3	Friendly ..	D 3	Kegley ..	F 6
Big Four ..	6	Cove Gap ..	B 4	Gallipolis Ferry ..	B 3	Kellysville ..	F 6
Bim ..	5	Cowen ..	E 4	Galloway ..	F 2	Kenna ..	C 3
Birch River ..	4	Craigsville ..	D 4	Gandeeville ..	D 3	Kenova ..	A 4
Blacksville ..	1	Cranberry ..	D 5	Gary ..	C 6	Kermit ..	B 5
Blair ..	5	Crum ..	B 5	Gassaway ..	D 3	Keyser ..	L 2
Blakeley ..	4	Cucumber ..	C 6	Gauley Bridge ..	D 4	Keystone ..	D 6
Blue Creek ..	4	Culloden ..	B 4	Gay ..	C 3	Kilsyth ..	D 5
Bluefield ..	6	Cyclone ..	C 5	Gem ..	C 3	Kimball ..	D 6
Bolair ..	4	Daniels ..	D 5	Gerrardstown ..	K 2	Kingwood ..	G 2
Bolivar ..	2	Danville ..	C 4	Ghent ..	D 5	Kirk ..	B 5
Bomont ..	4	Darkeville ..	F 2	Giatto ..	D 6	Kistler ..	C 5
Boomer ..	4	Davis ..	H 2	Gilbert ..	C 5	Kopperston ..	C 5
Borderland ..	5	Davisville ..	C 2	Gilboa ..	F 4	Lanark ..	C 5
Bradshaw ..	6	Davy ..	C 6	Glasgow ..	D 4	Landisburg ..	F 5
Bramwell ..	6	Dawes ..	D 4	Glen Dale ..	K 5	Landville ..	C 5
Brandywine ..	3	Dawson ..	F 5	Glen Daniel ..	D 5	Lavalette ..	B 4
		Decota ..	D 4	Glen Ferris ..	D 4	Layland ..	C 5
		Delbarton ..	B 5	Glen Jean ..	D 5	Lead Mine ..	C 2
		Deilslow ..	G 1	Glen Rogers ..	D 5	Left Hand ..	D 3
		Diana ..	F 3	Glenville ..	F 3	Levasy ..	F 4
						Lenore ..	B 5

⊙ County seat.

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Leon	C	Nellis	C 4	Renick	F 4	Verdunville	B 5
Lerona	C	Nevada	F 5	Rhodell	D 5	Vienna	D 9
Lesage	F 4	Nettle	G 4	Ridge	F 4	Vivian	D 6
Leslie	C	Nevinsburg	C 2	Ridgely	L 1	Volga	F 2
Lester	C	New Cumberland	K 4	Ripley	C 3	Wadestown	F 1
Letart	C	Nevins	C 2	Rippon	C 3	Waiteville	F 6
Lewisburg	C	New England	C 2	Rivesville	F 1	Wallace	F 2
Lindsie	C	Nevins	C 2	Rock Cave	C 3	Walton	D 3
Linn	C	Nevins	C 2	Roderfield	C 3	War	C 6
Little Birch	C	Nevins	C 2	Romney	C 3	Ward	D 4
Little Other	C	New Manchester	K 4	Ronceverte	F 1	Wardensville	L 2
Littletown	C	New Martinsville	F 1	Rosedale	C 2	Washington	C 2
Lizemores	C	New Milton	F 2	Rosmore	C 2	Washington Lands	K 6
Lockwood	C	Newtown	D 3	Rowlesburg	G 5	Waverly	D 2
Logan	C	Nitro	C 4	Rupert	C 3	Wayne	C 4
Lookout	C	Nolan	D 5	Russellville	C 4	Webster Springs	F 4
Lorado	C	Northfork	D 6	Saint Albans	C 4	Weirton	K 5
Lost Creek	C	North Mountain	K 1	Saint Marys	D 2	Welch	C 6
Lubeck	C	Porton	F 2	Salem	C 3	Wellsburg	C 5
Lumberport	C	Putt Fort	F 2	Salt Rock	C 4	West Columbia	B 3
Lundale	C	Oak Hill	D 4	Sand Fork	C 4	West Hamlin	B 4
Maben	C	Oakvale	D 4	Sandstone	C 4	West Liberty	K 5
Mable	C	Oceana	C 5	Sandyville	C 4	West Logan	C 5
Mabscott	C	Odd	D 5	Scarbro	C 4	West Milford	F 2
Madison	C	Ohley	D 4	Selwyn	C 4	Weston	F 2
Madsville	C	Okeefe	B 5	Seth	C 4	Westover	G 1
Malden	C	Omara	C 5	Shanghai	K 4	West Union	F 2
Mallory	C	Orma	D 3	Sharon	D 4	Wharcliffe	C 5
Mammoth	C	Orma	D 3	Sharps	C 5	Wharton	C 5
Man	C	Ossage	F 1	Shepherdstown	K 5	Wheeling	C 5
Mannington	C	Packsville	C 5	Sherrard	F 2	White Sulphur Sprs.	F 4
Marfrance	C	Paden City	D 1	Shinnston	F 2	Whitesville	C 4
Marlinton	C	Pager	D 4	Simpson	C 3	Whitmer	G 3
Marmet	C	Panther	C 6	Sissonville	C 3	Widen	F 4
Martinsburg	C	Parkersburg	C 6	Sistersville	D 1	Wiley Ford	L 1
Mason	C	Parsons	G 2	Slab Fork	D 5	Wilkinson	B 5
Masonstown	C	Paw Paw	K 1	Slate	C 5	Williamsburg	F 5
Matewan	C	Pax	D 5	Slate	C 5	Williamson	C 5
Matoka	C	Pecks Mill	B 5	Smithers	C 4	Williamstown	C 2
Mayberry	C	Pemberton	D 5	Smithfield	F 2	Wilsonburg	F 2
Maysel	C	Pence Springs	F 5	Smithville	D 2	Wilsondale	B 5
McCorkle	C	Pennsboro	F 2	Smoot	F 5	Windsor Heights	K 5
McDowell	C	Pentress	F 1	Sophia	D 5	Winfield	C 3
McMechen	C	Petersburg	H 3	South Charleston	C 4	Winifrede	C 4
McWhorter	C	Peterstown	E 6	Spanishburg	D 6	Winona	F 4
Meador	C	Phillipi	G 2	Spencer	D 3	Wolf Summit	F 2
Meadow Bridge	C	Pickens	F 3	Springfield	L 2	Womelsdorf	G 3
Meadowbrook	C	Pie	B 5	Squire	C 6	Woodlands	K 6
Meadow Creek	C	Piedmont	H 2	Star City	F 1	Worthington	F 2
Metz	C	Pinch	D 4	Stickney	D 5	Wymer	G 3
Middlebourne	C	Pine Grove	E 1	Stirrat	C 5	Yawkey	C 4
Middleway	C	Pineville	C 5	Stonewood	F 2	Yellow Springs	L 2
Midkiff	C	Poca	C 4	Stonesbury	D 5	Yolyn	C 5
Mill Creek	C	Pocotalico	C 4	Strange Creek	C 4		
Millstone	C	Point Pleasant	B 3	Summersville	C 4		
Millwood	C	Points	J 2	Summit Point	K 2		
Milton	C	Powellton	D 6	Sutton	C 3		
Minden	C	Powhatan	D 6	Sweet Springs	F 5		
Mineralwells	C	Pratt	D 4	Swiss	D 4		
Mingo	C	Premier	C 6	Switzer	B 5		
Missouri Branch	C	Price Hill	D 5	Sylvester	C 4		
Mitchell Heights	C	Prichard	A 4	Tabler	L 2		
Monaville	C	Princeton	D 6	Talcott	F 5		
Monclo	C	Prociuous	D 3	Tallmansville	F 3		
Monongah	C	Proctor	E 1	Teays	B 4		
Montana Mines	C	Pruntytown	F 2	Terra Alta	G 2		
Montcoal	C	Purgitsville	J 2	Tesla	F 3		
Monterville	C	Quick	D 4	Thacker	B 5		
Montgomery	C	Quincy	C 4	Thomas	H 2		
Moorefield	C	Quinwood	F 4	Thornton	G 2		
Morgantown	C	Rachel	F 1	Thorpe	D 6		
Morrisvale	C	Racine	C 4	Three Forks of Williams	C 4		
Moundsville	C	Radnor	A 4	River	F 4		
Mount Carbon	C	Rainelle	E 5	Tiosa	E 4		
Mount Clare	C	Raleigh	D 5	Triadelphia	K 5		
Mount Gay	C	Ranger	B 4	Tribble	C 3		
Mount Hope	C	Ranson	L 2	Tunnelton	G 2		
Mount Lookout	C	Ravenclyff	C 5	Turtle Creek	C 4		
Mount Nebo	C	Ravenswood	C 3	Uneeda	C 4		
Mount Storm	C	Raymond City	C 4	Union	F 5		
Mullens	C	Reader	E 1	Uppergrade	F 4		
Murphytown	C	Red House	C 3	Valley Bend	F 3		
Murraysville	C	Red Jacket	B 5	Valley Grove	L 5		
Nallen	C	Redstar	D 5	Valley Head	C 5		
Naugatuck	C	Reedsville	G 1	Van	C 5		
Nebo	C	Reedy	D 3	Varney	B 5		

Physical Features

Big Sandy (riv.)	A 4
Bluestone (lake)	E 5
Buckhannon (riv.)	F 3
Cacapon (riv.)	J 2
Cheat (lake)	G 1
Chesapeake and Ohio Canal Nat'l Mon.	J 1
Coal (riv.)	C 4
Elk (riv.)	D 4
Gauley (riv.)	D 4
Greenbrier (riv.)	F 4
Guyandotte (riv.)	B 4
Harpers Ferry Nat'l Hist. Park	L 2
Hughes (riv.)	D 2
Justice (res.)	C 5
Kanawha (riv.)	B 3
Little Kanawha (riv.)	D 3
Monongahela (riv.)	G 1
Mount Storm (lake)	H 2
New (riv.)	E 5
North (riv.)	J 2
Ohio (riv.)	B 3
Pocatalico (riv.)	C 3
Potomac (riv.)	L 1
Shenandoah (riv.)	K 3
Spruce Knob (mt.)	G 3
Stony (riv.)	H 2
Sutton (lake)	F 3
Tygart Valley (riv.)	F 3
Williams (riv.)	F 4

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cies, including the elk and gray wolf, have been extirpated. Deer, bear, fox, mink, raccoon, opossum, squirrel, skunk, and rabbit remain plentiful, however. More than 200 species of birds indigenous to the Appalachian region are found in the State. Reptiles include the timber rattlesnake and copperhead. Bass, trout, walleyed pike, perch, muskellunge, carp, bluegill, catfish, and sucker abound in the rivers and streams.

Parks, Forests, and Other Places of Interest.

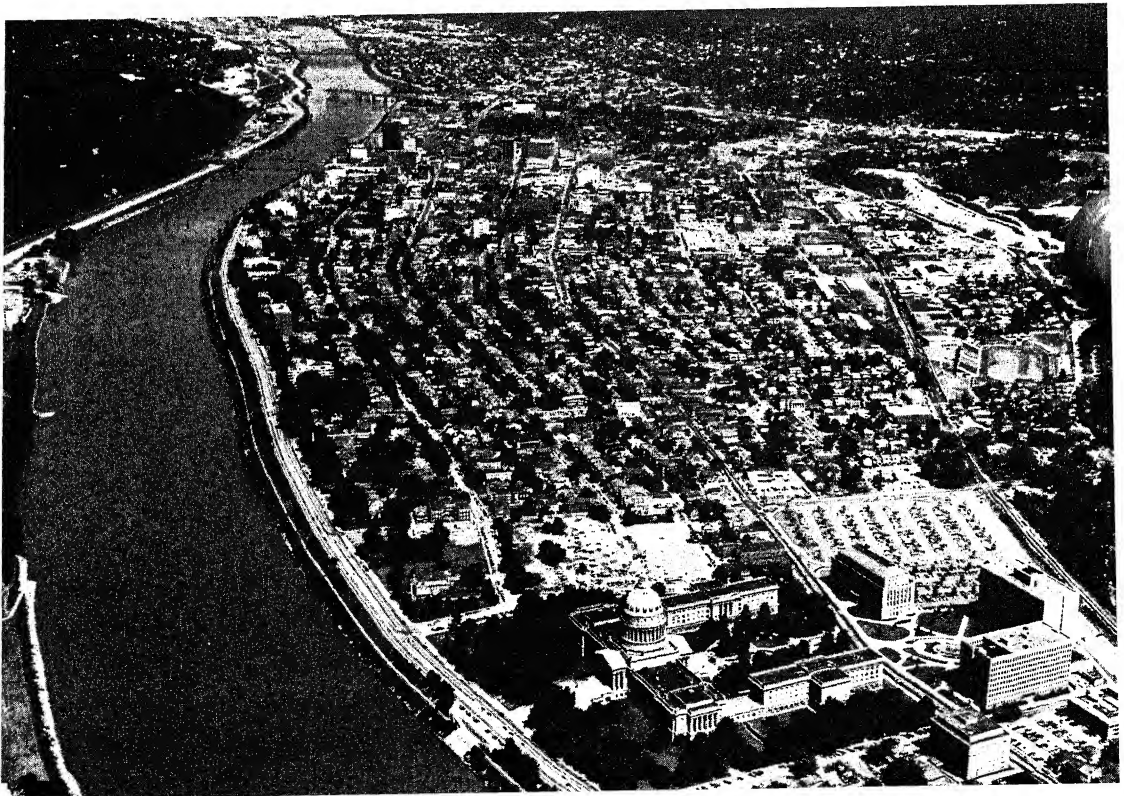
The Harpers Ferry National Historical Park, at Harpers Ferry (q.v.), is a scenic and historic area at the confluence of the Shenandoah and Potomac rivers in the Blue Ridge Mts.; it was the site of the famous raid by the American abolitionist John Brown (q.v.) and was of strategic importance during the Civil War. The one national forest in West Virginia comprises some 900,000 acres. Monongahela National Forest, with headquarters at Elkins, lies in the Appalachian and Allegheny mountains and contains Spruce Knob, highest point in the State. The Appalachian Scenic Trail, which extends from Maine to Georgia, has part of its route within West Virginia. Among the numerous parks maintained by the State are Blackwater Falls State Park, near Davis, with a 63-ft. waterfall; Droop Mountain Battlefield State Park, near Hillsboro, site of a

Civil War battle; Hawk's Nest State Park, near Ansted; and Watoga State Park, near Huntersville. Other points of interest in West Virginia include Ice Mountain, in Hampshire County, where, because of underground currents of cold air, surface ice can be found even on the hottest days; and Grave Creek Mound, in Moundsville, one of the largest Indian burial mounds in the country; see **MOUND BUILDERS**. At Jackson's Mill near Clarksburg are the farm and gristmill of the Confederate general Thomas Jonathan Jackson (q.v.), the legendary "Stonewall" Jackson.

Sports. West Virginia provides good sport fishing in rivers, reservoirs, and lakes. Brook, brown, rainbow, and golden trout are mostly stocked. Other freshwater species include largemouth and smallmouth bass, walleye, channel catfish, bullhead, and muskellunge. Game animals and birds hunted include white-tailed deer, black bear, cottontail rabbit, gray and fox squirrels, snowshoe hare, wild turkey, ring-necked pheasant, ruffed grouse, and bobwhite quail. West Virginia has winter sports activities in the e. part of the State. The Weiss Knob ski area, near Davis, offers several runs with drops of up to

Charleston, capital of West Virginia. The domed structure in the foreground is the State Capitol.

Governor's Office of Economic and Community Development



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625 ft. The ski season runs from December to April.

THE PEOPLE

According to the 1970 decennial census, the population of West Virginia was 1,744,237, a decrease of 6.2 percent from the 1960 population. The urban segment comprised 679,491 persons, 39.0 percent of the total, compared with 38.2 percent in 1960. The rural segment comprised 1,064,746 persons, 61.0 percent of the total, compared with 61.8 percent in 1960. Ethnically, the 1970 population was distributed as follows: white persons, 1,673,480, nonwhites, 70,757, including 67,342 Negroes, and a sprinkling of Indians, Japanese, Chinese, Filipinos, and others. The percentage of native-born residents was 99.0, of foreign-born, 1.0. The major countries of origin of the foreign-born, in order of rank, were Italy, Great Britain, and Germany. The 1970 population density averaged 72.5 per sq mi, compared with 77.2 in 1960.

The chief cities, in order of population, are Charleston, the capital and second-largest city, a manufacturing and shipping center, Huntington, the largest city, a manufacturing and railroad center, Wheeling, the third-largest, commercial center of a broad industrial area,

Parkersburg, the fourth-largest, an Ohio River port and industrial and rail center, Morgantown, the fifth-largest, an industrial center and site of West Virginia University, and Weirton, a steel-manufacturing city.

Education. The public-school system of West Virginia was established in 1863. Education is compulsory for all children between the ages of seven and sixteen.

ELEMENTARY AND SECONDARY SCHOOLS. In the early 1970's public elementary schools numbered about 1025 and public secondary schools, about 345. Enrollment was about 284,000 in elementary and 120,000 in secondary schools. Teachers in the public-school system numbered about 8860 in elementary and about 7890 in secondary schools. In the early 1970's private institutions included about 55 elementary schools with some 9000 students, and about 20 secondary schools with some 4000 students. Teachers in private schools numbered about 800 in the late 1960's.

UNIVERSITIES AND COLLEGES. In the early 1970's West Virginia had twenty-two institutions of higher education, eleven of which were public. University and college enrollment was about 64,000. Public institutions include West Virginia Uni-

*The downtown shopping
area of Charleston
West Virginia Dept. of Commerce*





The Sunrise Museum in Charleston.

West Virginia Dept. of Commerce

versity, Marshall University, West Virginia Institute of Technology, Shepherd College, Concord College, and State colleges at Bluefield, Fairmont, Glenville, West Liberty, and Institute. Private institutions include Bethany College, Davis and Elkins College, Morris Harvey College, Salem College, and Wheeling College.

Libraries and Museums. The West Virginia University Library in Morgantown contains 950,000 volumes. Museums in West Virginia include the Museum of the Department of Archives and History, in Charleston, with a collection of prehistoric artifacts and an exhibit relating to the American pioneer Daniel Boone (q.v.); the Huntington Galleries, with a comprehensive art collection including Georgian silver and French tapestries; and the Mound Museum, in Moundsville, containing Indian relics and Ohio Valley archeological items. The University of West Virginia has a Native Wildlife Museum.

THE ECONOMY

West Virginia has a diversified economy. Per capita personal income was \$5394 in 1976, compared with \$6441 for the U.S. as a whole. Agriculture employs about 6 percent of the State's workers and mining engages another 8 percent. Nonagricultural workers are employed, in descending order of numbers, in manufacturing;

wholesale and retail trade; government; service industries; transportation and public utilities; construction; and finance, real estate, and insurance. Mining employment, depressed for some time, was rising toward the end of the 1970's, as the demand for soft coal began to accelerate. Some 10,000,000 tourists visit the State annually, spending about \$540,000,000.

Manufacturing. The abundant mineral resources of West Virginia support important manufacturing industries. According to a recent survey of manufactures, production workers total 86,800. The largest groups are employed in the primary-metals industries, the manufacture of stone, clay, and glass products, and the chemicals industries. About 17 percent are employed in the West Virginia portion of the Standard Metropolitan Statistical Area (q.v.) of Steubenville-Weirton. Other manufacturing centers are the S.M.S.A.'s of Huntington-Ashland, Charleston, Parkersburg-Marietta, and Wheeling. In the mid-1970's the value added by manufacture (see VALUE) in the largest industries totaled about \$1.03 billion for chemicals, \$583,700,000 for primary metals, and \$374,000,000 for stone, clay, and glass products. The value

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added by all manufacturing in the State was about \$3.07 billion annually.

Agriculture. In West Virginia agriculture is dominated by the production of livestock and related products. The State's principal commodities, in terms of cash receipts, are milk, cattle, apples, and broilers. Other important crops include hay, corn, and tobacco. About 41,000 persons work on some 26,500 farms covering 4,750,000 acres; the average size of a farm is about 180 acres. In the mid-1970's total cash receipts from agriculture (including government payments) amounted to about \$143,223,000 annually. Of this total, about \$103,442,000 was from livestock and \$37,190,000 from crops. West Virginia ranked forty-seventh in the U.S. in cash receipts from agriculture.

Mining. In the mid-1970's West Virginia ranked third among the States in value of mineral production. It was the second leading producer of coal in the nation. Other important mineral products include natural gas, petroleum, and natural-gas liquids. The value of minerals produced annually in West Virginia during the mid-1970's was about \$3.39 billion, representing 5.44 percent of the U.S. total.

Energy. Generating plants in West Virginia, with a capacity of 12,400,000 kw, produced about 68.9 billion kw hours of electric energy annually in the mid-1970's. Less than 5 percent of the capacity was publicly owned, and all of the production was privately owned. Despite many streams and rivers, most of the State's electricity is generated in steam plants.

Forestry. The forest land of West Virginia consists predominantly of hardwoods. The commercial forest land, primarily under private ownership, comprises some 12,000,000 acres. It produces a net annual cut of sawtimber of about 663,000,000 bd.ft.

Transportation. The first railroad in West Virginia was the Winchester & Potomac Railroad, inaugurated on Mar. 14, 1836, and now a part of the Baltimore & Ohio Railroad. At present the State has a total of about 3460 mi. of railroad line in operation. Rural and municipal roads total some 37,000 mi.; Federally assisted primary and secondary roads total about 13,620 mi., including 511 mi. in the Interstate Highway System. West Virginia is served by 2 international airlines and 3 local and interstate lines. The State has some 22 public and 29 private airports. West Virginia's most important port is Huntington, on the Ohio R. The Ohio, which forms the boundary with the State of Ohio, is the major navigable waterway. Other navigable streams include Tug Fork and the Big Sandy, Kanawha, Little Ka-

nawha, and Monongahela rivers.

Communications. The first newspaper in West Virginia was the *Potomac Guardian and Berkeley Advertiser*, founded in Shepherdstown in 1790. Today the State has about 29 daily newspapers, with a total circulation of 470,000, and 9 Sunday papers, with a total circulation of 380,000. Among the leading papers are the *Charleston Gazette and Mail* and the *Huntington Herald-Dispatch and Advertiser*. Of some 106 radio stations operating in the mid-1970's, among the oldest was WSAZ (1923) in Huntington. There were twelve television stations.

GOVERNMENT

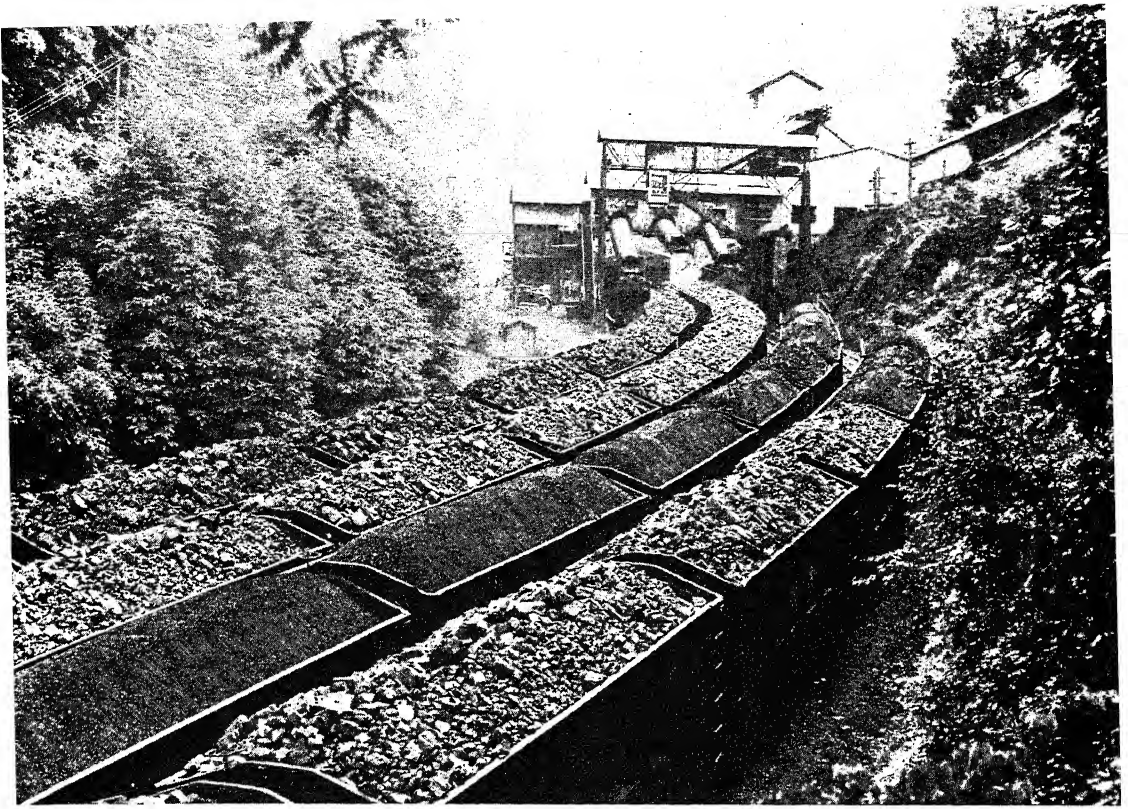
West Virginia is governed under the constitution of 1872, as amended. Executive authority is vested in a governor, an attorney general, an auditor, a treasurer, a commissioner of agriculture, and a secretary of state, all elected for four-year terms, and appointed officials. Legislative authority is exercised by the Senate, with thirty-four members elected for four-year terms; and the House of Delegates, with one hundred members elected for two-year terms. The legislature meets annually. The judicial system includes a five-member supreme court of appeals, circuit courts, and local and special courts. The State is divided into fifty-five counties.

West Virginia is represented in the United States Congress by two Senators and four Representatives.

Voting Qualifications. Suffrage is extended generally to U.S. citizens eighteen years of age who have resided one year in the State and sixty days in the county.

HISTORY

Before 1863 the region that is now West Virginia was part of the State of Virginia, and earlier it had also been included in the Royal Province of Virginia; see VIRGINIA: *History*. The first European to explore the territory of West Virginia was probably John Lederer, a German surgeon in the employ of the colonial governor Sir William Berkeley (q.v.); Lederer traveled in the region in 1669. In the same year Robert Cavalier, Sieur de La Salle (q.v.), journeyed down the Ohio R. and landed at several places in the region. The first permanent settlement is thought to have been made in 1731 in what is now Berkeley County. After 1732 Scotch-Irish, Welsh, and German pioneers began to settle the western portion of Virginia. They soon came into conflict with the French, who also claimed the country (see FRENCH AND INDIAN WAR). The Indians resented the white man's continuous advance into the Ohio Valley, and in 1774, at Point Pleasant, an extremely bloody battle was fought



Coal is loaded into railroad cars at a mine. West Virginia is a leading State in the production of bituminous coal.

between Virginia settlers and militia and a confederacy of Shawnee, Delaware, Wyandot, Cayuga, and other Indian tribes led by Cornstalk (1720?-77), a Shawnee Indian chief. The Virginians won the battle, which concluded the campaign, known also as Lord Dunmore's War (see DUNMORE, JOHN MURRAY), and extracted a treaty from the Indians that forced them to give up much of the disputed land.

A Backwoods Society Developed. An entirely different society grew up in the western woods of Virginia from that in the east. The backwoodsmen had few luxuries, few Negro slaves, and little contact with European culture. Jealousies arose between the eastern and western sections, and the western settlers complained bitterly that they had all the burdens of government without the corresponding benefits. The representation in the eastern counties was based partially upon the number of slaves. The western counties of Virginia did not have the same representation because of the scarcity of slaves in the region. As early as 1783, the settlers west of the Allegheny Mts. had attempted, unsuccessfully, to create a new State called "Westsylvania". The Virginia counties west of the Alleghenies protested strongly when, in 1829, a State convention drew up a constitution that favored, in regard to representation, the slave-

holding counties of Virginia and also retained property qualifications for suffrage. As a result, the trans-Allegheny counties voted, with one exception, to reject the document, which, however, was carried by the surplus of votes cast in the east. Another source of dissatisfaction in the west was the inequitable distribution of funds for road and railway construction and for other internal improvements. The split between the eastern and western portions of Virginia grew more acute as the Civil War approached; a number of the western Virginia counties bordered on the free States of Ohio and Pennsylvania, and many of the counties were Northern in sentiment. When Virginia passed the ordinance of secession in 1861 there was much dissatisfaction in the western part of the State. Of the forty-seven delegates from the trans-Allegheny counties, only eleven voted for secession. Numerous small meetings were held in western Virginia, and on May 13, 1861, delegates from twenty-five counties met at Wheeling and called a convention to meet on June 11. Representatives from forty counties attended, voted to void the acts of Virginia's secession convention, declared their independence from Vir-

WEST VIRGINIA

ginia, and established a provisional government. On July 2, a legislature met and elected representatives to the United States Senate; the representatives were admitted by that body. The people also voted overwhelmingly for the formation of a new State. Between November, 1861, and February, 1862, a constitution was framed, and on May 13 the legislature of the "Restored Government of Virginia" petitioned the United States Congress for admission. On Dec. 31, 1862, President Abraham Lincoln (q.v.) approved the act of admission to the Union, to take effect upon the insertion into the State constitution of a clause that would provide for the gradual emancipation of slaves. The provision was added to the constitution, and on June 20, 1863, West Virginia was formally admitted to the Union; independence from Virginia was actually made possible by Union military victories, including those at Rich Mt., Corrick Ford, Carnifex Ferry, and Cheat Mt.

The Civil War and After. In the Civil War much of the population was under arms. More than 32,000 men from the new State served in the Federal army; about 8000 men served in the Confederate army; see CIVIL WAR, THE AMERICAN. On Feb. 3, 1865, before the adoption of the Thirteenth Amendment to the Constitution of the United States (q.v.), slavery (q.v.) was entirely abolished by West Virginia. The return of the Confederate soldiers, who came primarily from the southern and eastern counties of West Virginia, threatened the Republican Party control of the State and caused a great deal of tension; it resulted, in 1866, in an addition to an amendment to the constitution disfranchising all who had given aid and comfort to the Confederacy after June, 1861. The amendment was abrogated in 1871, and in 1872 an entirely new constitution went into force as a result of a return to power of the Democratic Party.

Growth of the State. West Virginia's industrial growth dates from the final decades of the 19th century, when the development of natural gas as a power source attracted many industries to the State. Coal mining also progressed swiftly, but working conditions were poor and wages low. Even after the United Mine Workers of America was formed in 1890, conditions improved only minimally. Decades of bitter labor disputes followed, and there was little real improvement until 1933. During World War II, West Virginia supplied many raw materials, but the postwar shift from coal to oil and gas and the mechanization of mining caused many jobless workers to leave the State. Labor troubles continued in the 1960's. Floods and mine disas-

ters took a heavy toll in lives and property, which resulted in strong Federal legislation governing mine safety standards. In its efforts to halt the population decline, West Virginia today encourages the increase of manufacturing industries and new markets for coal.

WEST WARWICK. See WARWICK.

WESTWOOD LAKES, unincorporated community of Florida, in Dade Co., bordering on Snapper Creek Canal, 11 miles s.w. of downtown Miami. Primarily residential, the area includes Olympic Heights, in the e. part. Nearby to the e. is Tropical Park Race Track. Pop. (1960) 22,517; (1970) 12,811.

WETHERSFIELD. See HARTFORD: *Commerce and Industry*.

WEXFORD, maritime county of the Republic of Ireland, in Leinster Province, on Saint George's Channel. The surface is mostly level; in the mountainous n.w. the highest point is Mt. Leinster (2610 ft.). The county coast line is low, irregular, and hazardous to navigation. Bannow Bay, Waterford Harbour, and Wexford Harbour are the chief inlets. The Slaney is the principal river. Wexford is the leading agricultural county of the Republic of Ireland; approximately one third of the land is under cultivation. Grains and root vegetables are the chief crops; hogs, poultry, and dairy cattle are raised. There are extensive fisheries. Slate and marble are quarried. Other industries include the curing of bacon and ham, tanning, wool processing, brewing, and the manufacture of agricultural machinery. The largest city and the administrative center is Wexford. Other towns include Enniscorthy and New Ross. Area, 908 sq.mi.; pop. (1971) 85,892.

WEYDEN, Rogier van der (Fr. *Roger de La Pasture*) (about 1400–64), Flemish painter, born in Tournai, Belgium. He was apprenticed to the Flemish painter Robert Campin (see FLÉMALLE, LE MAÎTRE DE) about 1427. In 1432 Van der Weyden qualified as a master of the painters' guild of Tournai, and in 1436 he became the town painter of Brussels. He probably visited Italy in 1449–50.

Although none of his paintings is dated or signed, some of them have been authenticated. Among his principal known works are "Descent from the Cross" (about 1435, Prado Museum, Madrid), generally regarded as his masterpiece, and the altarpieces "Last Judgment" (about 1445, Hospital of Beaune, France) and "The Adoration of the Kings" (about 1460, Bayerische Staatsgemäldesammlungen, Munich). His portraits include "Portrait of a Lady" (about 1455, National Gallery of Art, Washington, D.C.) and "Francesco d'Este" (about 1455, Metropolitan Museum of Art, New York City).

"Portrait of a Lady"
(about 1455) by Rogier
van der Weyden.

National Gallery of Art -
Mellon Collection



Van der Weyden excelled in the portrayal of emotion, conveying great pathos with dignity and restraint. He is best known for his Biblical paintings, which combine graceful, stylized poses with realism of expression. During the 15th century he was the most widely copied Flemish artist. See FLEMISH ART AND ARCHITECTURE: *Painting*.

WEYGAND, Maxime (1867–1965), French general, born in Brussels, Belgium. He was trained at Saint-Cyr, the French military academy, and served during World War I as chief of staff for the French general Ferdinand Foch (q.v.). Sent to Poland in 1920, he led the Polish army in a victorious counteroffensive against invading Soviet troops; later, he served (1923) as French high commissioner in Syria. From 1930 to 1935

he was chief of the French army general staff, then in 1939, with war imminent again, he was named commander in chief of French forces in the Middle East. Appointed commander in chief of the French Army in 1940, he was unable to stem the German advance through France and advised the French government to arrange an armistice with Germany. In the succeeding Vichy government of Marshal Henri Philippe Pétain (q.v.), Weygand served as defense minister (1940), governor-general of Algeria (1940), and delegate general of the Vichy government in French Africa. Arrested by the Gestapo (q.v.) in 1941, when he opposed German policies in French Africa, he was imprisoned in Germany until 1945. After World War II, he was acquitted of all charges of collaboration.

WEYMOUTH

WEYMOUTH, town of Massachusetts, in Norfolk Co., on Boston Bay, 11 miles S.E. of Boston. The town comprises several villages, among them North Weymouth, East Weymouth, and South Weymouth. The chief manufactures are shoes, paper boxes and paper tubes, and tools. Weymouth is the birthplace of Abigail Smith Adams, wife of John Adams (q.v.), second President of the United States. Settled in 1622, it is the second-oldest community (after Plymouth) in Massachusetts. The town was incorporated in 1635. Pop. (1960) 48,177; (1970) 54,610.

WHALE, name applied commonly to the large marine mammals of the order Cetacea and more broadly including the smaller porpoises and the dolphins. Whales may be divided into two main groups, the baleen whales, belonging to the suborder Mysticeti, and the toothed whales of the suborder Odontoceti. Each group consists of many species. The baleen, or whalebone, whales include the right whale, the gray whale, the humpback; and the rorquals, such as the finback, the blue whale, and the bowhead. Among the toothed whales are the killer whale, or grampus, the sperm whale or cachalot, the beluga (q.v.), the porpoises, and the dolphins.

Despite its fishlike form, the whale is a warm-blooded mammal that breathes air and will drown if submerged too long. Vestigial bones in the whale's skeleton indicate that its ancestors once lived on land and walked on four legs like other mammals. With its adaptation to aquatic life, the external hind limbs disappeared and the forelimbs became flippers. The tail of the whale terminates in two horizontal lobes, known as flukes, which provide propulsion by a rotatory motion. The body is streamlined and almost entirely hairless, and beneath the skin is a thick, insulating layer of fat, or blubber.

The nostrils, called blowholes, are situated in most whales at the top of the head and are closed automatically as the whale submerges. Baleen whales have two blowholes, and toothed whales have one. Upon rising to the surface to breathe, the whale expels the stored-up air from its lungs. The ejected air, moist and warmer than the atmosphere, condenses to form a column of vapor, which is the basis for the popular misconception that whales spout water. An average dive for most species is from three to ten minutes, but some of the toothed whales, which dive to very great depths in pursuit of food, can remain submerged for longer than a half hour.

Unlike land mammals, including man, whales are able to withstand the tremendous water pressure found at great depths in the ocean. Evidence exists that whales can submerge to more

than 3000 ft. below the surface of the ocean. (The carcass of a sperm whale was once found tangled in telephone cable at a depth of about 3700 ft.) Water pressure at such a depth exceeds 1400 pounds per square in. A human rib cage, which is relatively rigid, would be crushed under much lower pressure. The rib cage of a whale, however, withstands the pressure because it is more flexible (compressible) than that of a land mammal. As pressure builds up, the rib cage of the whale contracts upon the lungs. This contraction increases the air pressure within the lungs so that it equals the water pressure pushing against the ribs from outside, thus reinforcing the rib cage by internal air pressure.

Whales vary in size from about 20 ft. to over 110 ft. Although they mate unobserved, apparently below the surface of the ocean, it is known that some species breed only once every other year and have a gestation period of 11 to 16 months. The size of the young varies with that of the mother. An 80-ft. whale is reported to have given birth to a 25-ft. calf weighing 8 tons. The mother suckles her young for six or seven months. Remarkable in the rapidity of their development, the calves of some species double in size by the time they are weaned. Little is known about the life span of the whale; authoritative guesses range from 20 to 50 years.

Several species have long been of commercial importance for their blubber, meat, whalebone, waxes, or ambergris (q.v.); see **WHALING**.

Baleen Whales. The chief characteristic of baleen whales is a massive fringe of long, horny plates, known popularly as whalebone, extending downward from the upper jaw and serving to strain food from the water. The food consists largely of plankton and small crustaceans. The baleen cows are generally slightly larger than the bulls.

BLUE WHALE. The largest whales, the rorquals, are part of the family Balaenopteridae, and include the fastest-swimming members of the order. Most species are distinguished by the presence of a well-developed dorsal fin. The largest member of this family is the blue whale, or sulfur-bottom, *Sibbaldus musculus*, which attains a length of 110 ft. The most gigantic creature ever known, it exceeds in size the extinct dinosaur (q.v.); one specimen 95 ft. in length was estimated to weigh about 120 tons. Although relatively rare as a result of uncontrolled whaling, except in antarctic waters, the blue whale may be found in all the oceans of the world. The species is considered a great prize by whalers because of its high yield of oil and other useful

products. It is blue gray in color and has a small dorsal fin on the lower back. The whalebone is black and about 3 ft. long. It can attain a speed of about 15 knots.

FINBACK. Another rorqual is the finback, *Balaenoptera physalus*, the commonest of the large whales. Found in all oceans, it is especially numerous in the Atlantic Ocean and constitutes the mainstay of the present-day whaling industry. It is a fast swimmer and a valuable catch because of its size, which reaches a maximum of about 70 ft. It is gray above and white beneath, and has a markedly hooked dorsal fin. The coloring of the head is asymmetrical, the right side being whiter than the left. Similarly, the whalebone, which is mostly gray, is lighter at the right of the jaw and darker at the left.

LESSER RORQUAL. The smallest rorqual is the lesser rorqual, *B. acutorostrata*, with a maximum length of about 28 ft. It has short, white whalebone, and its body is dark with a white belly. A very common species in all oceans, it has never been sought after by whalers because it yields little oil or whalebone.

RIGHT WHALES. Among the baleen whales lacking the dorsal fin is the black right whale, *Eubalaena glacialis*, which attains a maximum length of 55 ft. This species is now rare, but was formerly

common in all temperate seas. Easy to catch, it was decimated by whalers for its high yield of oil and 7-ft.-long whalebone before the establishment of international whaling regulations. The right whale is distinguished by its huge, arched head.

Another species of right whale is the bowhead, *B. mysticetus*, known also as the Arctic, or Greenland, right whale, which is confined to the Arctic Regions. This species also suffered severe depredation before it was afforded protection by conservation laws.

GRAY WHALE. Another baleen whale now legally protected is the gray whale, *Eschrichtius glaucus*, a species native to the northern Pacific Ocean. About 45 ft. long, it was formerly found in great numbers in the coastal waters of California, but was almost exterminated by whalers. In recent years, as a result of whaling regulations, its numbers have increased and as many as 500 have been reported by observers on a single day.

HUMPBACK WHALES. The humpbacks are baleen whales of the genus *Megaptera*, native to all oceans. Humpbacks are so called because of their arched backs. They reach a length of 55 ft. and are black, blotched with white. Humpbacks have characteristically long flippers, the tip-to-

Killer whale, *Orcinus orca*
UPI



WHALE SHARK

tip span measuring almost one third of the body length. Conspicuous for their awkward, clownish behavior on the surface of the ocean, humpbacks are slow swimmers and easy prey for whalers. Barnacles infest the head, flippers, and flukes of the humpbacks.

Toothed Whales. The toothed whales are distinguished by the presence of teeth either in the lower or in both the jaws. These whales feed mainly on cuttlefish, and the bulls are generally larger than the cows.

SPERM WHALE. Of the toothed whales, the most important species is the sperm whale, or cachalot, *Physeter catodon*, found in all oceans. The males of this species may be as long as 65 ft., but the cows rarely exceed 35 ft. in length. The only whale with a throat large enough to swallow a man, the sperm whale is fond of squid, for which it dives to great depths. The sperm whale has large, conical teeth in the lower jaw and smaller, nonfunctional teeth in the upper jaw. About one third of its total length consists of the rectangularly shaped head, which contains a huge cavity filled with a mixture of fine oil and a waxy substance called spermaceti. Spermaceti, used formerly in candles, is now employed in the manufacture of cosmetics and medicines. Ambergris, used in expensive perfumery, is an intestinal secretion of the sperm whale and is found floating on the surface of the ocean. The sperm whale is a valuable catch for whalers, but a dangerous antagonist, capable of destroying whaling boats by powerful blows with its tail or by ramming with its head. The formidable Moby Dick of the famous novel by the American author Herman Melville (q.v.) was an albino sperm whale.

KILLER WHALE. Another toothed whale is the killer whale, *Orcinus orca*, worldwide in distribution and reaching a length of 20 ft. The back and sides are black and its underparts white, and each jaw contains an average of twenty-four sharp, conical teeth. The killer is the only whale which preys on mammals. It attacks seals, porpoises, squid, walrus, penquins, and larger baleen whales, including the defenseless but faster-swimming blue whale. It is extremely dangerous to man. The killer whales are called sea wolves by the Eskimos because of their voraciousness and because they hunt in packs.

WHALE SHARK, common name for the largest shark (q.v.), *Rhincodon typus*, native to tropical seas throughout the world, and the largest known fish in existence. The whale shark may attain a length of over 50 ft. and weigh more than 20 tons. It is darker in color than most sharks, but its body is marked with white spots

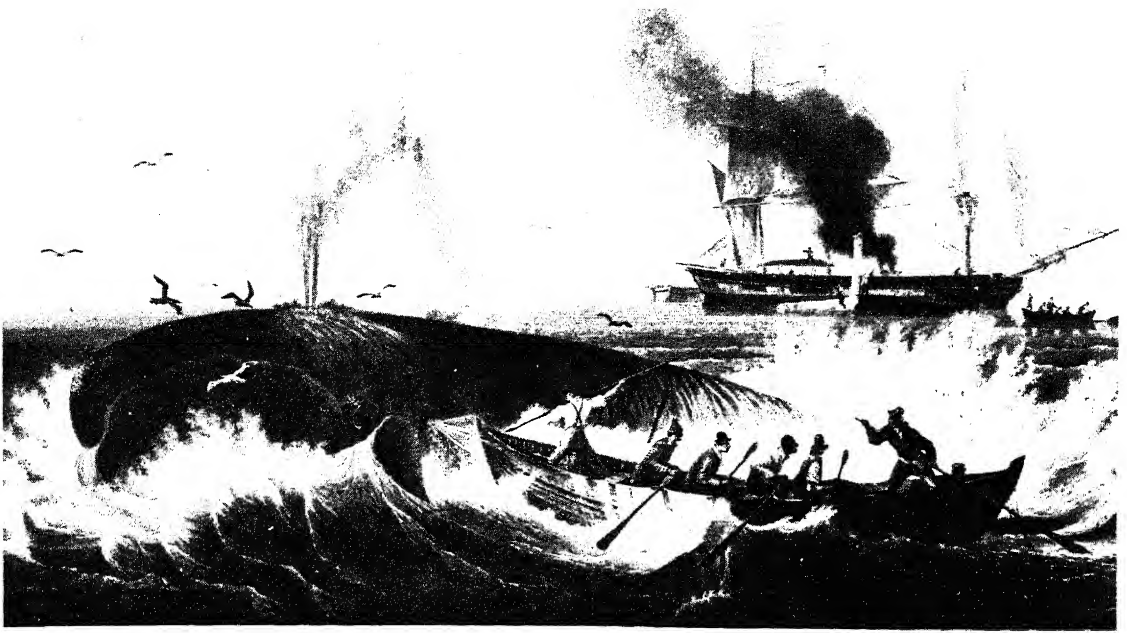
and vertical lines; on its back are several longitudinal ridges. It has numerous small teeth in each jaw. Harmless to man, the whale shark feeds on small fishes and plankton strained out of the sea water by its long gill rakers.

WHALING, commercial enterprise of hunting whales to obtain oil, whalebone, meat, and various by-products, occasionally including ambergris (q.v.); see WHALE. The origins of whaling are obscure, but evidence exists that whales were hunted for food and oil in prehistoric times. Throughout recorded history, whaling has contributed substantially to the wealth of many nations and has been dominated successively by the Norsemen, Basques, English, Dutch, American, Norwegian, and Japanese and Russian whalers.

Early History. The earliest record indicating whaling being carried out as an organized business is dated about 875. By the 12th century, whaling in the Bay of Biscay was one of the principal industries of the Basque provinces of Spain and the Gascogne region of France. Overfishing forced these whalers to pursue their quarry in other regions, and they are known to have hunted whales off the coast of Newfoundland after 1550. Spitsbergen (q.v.), rediscovered in 1596 by the Dutch navigator Willem Barents (q.v.), became the center of English and Dutch whaling during the 17th century; many of the English vessels had Basque crews. When whales became scarce here, the industry shifted to Greenland and the Davis Strait. The latter grounds were also nearly fished out, or depleted, by the 19th century.

American Whaling. American whaling began almost simultaneously with settlement but, as was the case in other areas, the first activity of the colonists was limited to processing drift whales, that is, floating whale carcasses. They soon progressed to killing whales near the shore and by the 18th century were hunting in the ocean. Nantucket and Cape Cod, Mass., and eastern Long Island were the original centers of early American whaling. Nantucket became the most important of the three and retained the leadership until about 1830, when New Bedford (q.v.) became the world's most important port. Other American ports with large fleets were Provincetown, Mass.; New London, Conn.; San Francisco, Calif.; and Sag Harbor, N.Y. In all, more than seventy American ports sent out whalers.

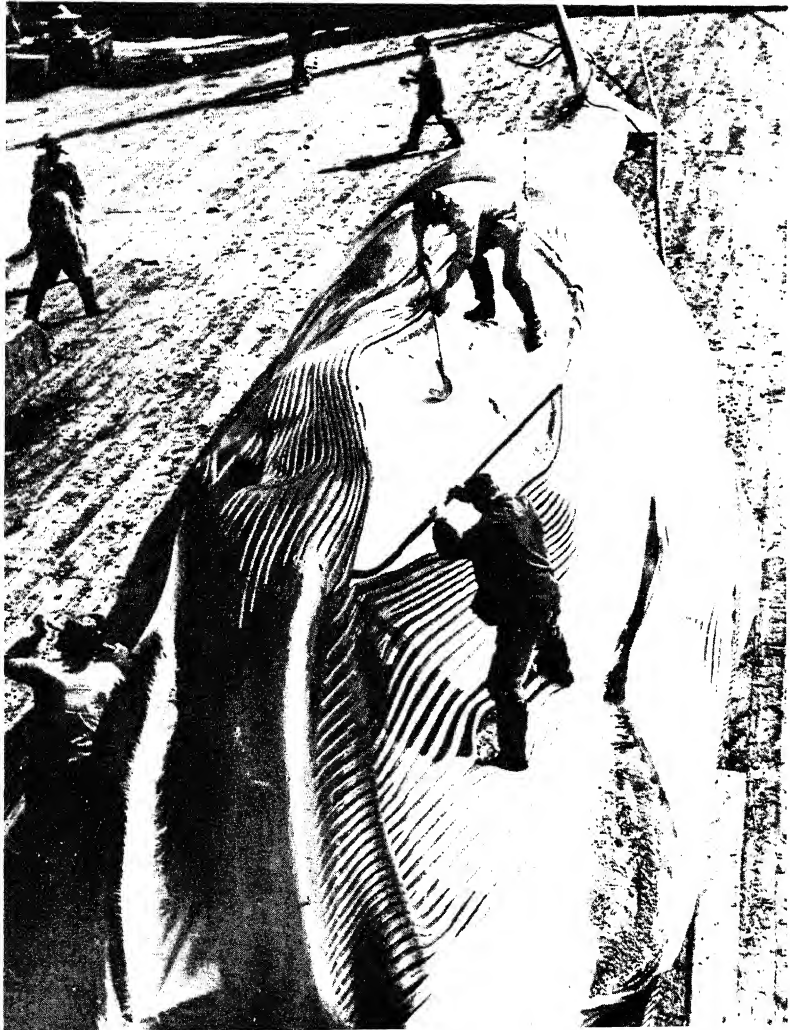
The peak year for American whaling was 1846 when 736 vessels, totaling more than 233,000 tons and valued at \$21,000,000, were engaged in the fishery. Investments in related activities



UPI

Mariners Museum

Since prehistoric times man has crisscrossed the oceans tracking whale herds for thrill and profit. The early whaling vessels were just small rowboats (above), launched from schooners as soon as the whale herd was sighted. A dangerous antagonist, the whale was capable of destroying these boats by powerful blows with its tail or by ramming with its head. Modern whaling flotillas include huge factory ships (right) onto the deck of which the whale carcass can be hauled for processing.



WHALING

brought the total to \$70,000,000, and 70,000 people were employed in the industry. Although more vessels were engaged in 1846 than in any other year, this was not the year of greatest productivity or of greatest value of the products. Sperm oil sold highest at \$2.55 per gallon, whale oil at \$1.45 per gallon, and whalebone at \$5.38 per pound. In production sperm oil peaked at 5,260,000 gal. in 1843, whale oil at 11,593,000 gal. in 1845, and whalebone at 5,652,000 lb. in 1853.

Gradual decline, which began in 1847, was hastened by the decimation of the herds of whales even though several new whaling grounds were opened after that date. Other factors that contributed to the decline of whaling were the introduction of kerosene (see LAMP) as a cheap illuminating fuel to replace whale oil and candles; the sinking of numerous whalers in Charleston, S.C., to block the harbor and the destruction of many other whaling vessels by Confederate commerce raiders during the American Civil War; and two disasters that destroyed nearly fifty vessels in the Arctic Ocean.

The last American whaling vessel sailed in 1928. Today, of the once prodigious fleet, only one ship remains. The vessel, *Charles W. Morgan*, built in New Bedford in 1841, is preserved by The Marine Historical Association in Mystic, Conn. In her 80-yr. whaling career, the *Morgan* brought back oil and bone valued in total at more than \$1,400,000. A vivid picture of whaling in 19th-century America is given in the classic novel *Moby Dick*, by the American author Herman Melville (q.v.).

Following the decline of American whaling, the Norwegians assumed the leadership among whaling nations. They ceased whaling in 1969, however, and today the only nations with whaling fleets are Japan and the Soviet Union.

Weapons. Throughout most of recorded history whales were killed, with hand-thrown harpoons and hand-held lances, by men in whaleboats that ranged in length from 20 to 28 ft. As early as 1731, one whaler devised an 80-lb. gun, but it never was used widely. In 1840 a 55-lb. gun was introduced, and this type was still in use thirty years later. Several shoulder guns, which fired explosive lances, were introduced in the 19th century. Another type was called a harpoon gun, which was a lance-firing mechanism attached to a hand-thrown harpoon. By the mid-1870's, the hand-held lance had been almost completely replaced by bomb lances. Ultimately these bomb lances were replaced by guns mounted on the bows of the catcher boats.

Voyages, Vessels, and Crews. Early whaling voyages lasted only a few weeks or, at most, 3 or

4 months. As whale herds near the shore declined, however, the voyages became necessarily longer. During the peak period of American whaling, from 1835 to 1865, the average voyage was 2½ to 3 yr. The longest recorded voyage was the 11-yr. outing on the ship, *Nile*, of New London, which lasted from May, 1858, to April, 1869, during which time she had eleven different captains.

The earliest whaling vessels were probably small rowboats that were launched from the shore whenever whales were seen. Little is known about the size of the vessels of the Norsemen, the Basques, or the English and Dutch, but the earliest American vessels were sloops of 30 to 40 tons; see SLOOP. Gradually schooners and brigs of 100 to 150 tons were added, and by the 19th century, ships and barks of 300 to 400 tons were predominant. Late in that century, steamers of 500 tons were added to the whaling fleets.

Present-day whaling is carried on in factory ships, the first of which was introduced in 1870. Not until 1925 was a ship produced onto the deck of which a whale could be hauled for rendering, or carcass processing. These vessels today approach 40,000 tons. They are supported by one or more tankers, to exchange fuel oil for rendered whale oil; one or more refrigerator ships, if whale meat is being processed for human consumption; and as many as ten catcher boats of 500 tons, to kill and mark whales for buoy boats to tow to the factory ship. See BOAT; SHIPS AND SHIPBUILDING.

The method used by those other than the 19th-century British and American merchants to pay the whalers is not known. The British paid a set sum per month, whereas the Americans paid by the lay or share system. Each crewman agreed to serve for the whole voyage for a given percentage, which varied according to the man's position. Captains received about ½ of the total value of the oil and bone taken on a voyage, whereas so-called green hands, or unskilled crew members got about ⅙₇₅, and cabin boys, as little as ⅙₃₅₀. Others, such as mates, boat-steerers or harpooners, cooks, stewards, carpenters, coopers, blacksmiths, engineers, and able seamen, received percentages according to their position and experience.

The size of the crew of a whaling vessel varied according to the number of hunting boats carried or employed. Vessels which carried only two boats had crews of thirteen or fourteen, whereas those which carried five or more boats had correspondingly larger crews. Each boat required a boatheader, who usually was one of

the mates, a harpooner, and four oarsmen. Certain members of the crew, such as cook, steward, cooper, blacksmith, engineer, and cabin boy, never went out in the boats.

Regulation. For many centuries whaling was regulated only by the number of whales available, the ability of the whalers to catch them, and the demand for oil and bone. By 1946 it was apparent that this situation could not continue. In that year, an international convention held in Washington resulted in the formation of the International Whaling Commission. The commission regulates whaling by (1) setting geographical limitations, (2) prohibiting the taking of certain species like the arctic right and blue whales, (3) establishing rules for safeguarding immature whales and females with suckling calves, and (4) limiting the operations of factory ships and shore stations. The commission employs observers who report violations of its standards, but it does not have the power to punish violators. See also GAME AND GAME LAWS.

C.R.S.

WHARF. See DOCK; HARBOR.

WHARTON, Edith Newbold (1862–1937), American writer, born Edith Newbold Jones in New York City, and educated privately. In 1885 she married the American banker Edward Wharton, from whom she was divorced in 1913. She wrote a number of short stories during the 1890's for *Scribner's Magazine*, and in 1902 she

published a historical novel, *The Valley of Decision*. Her literary reputation was established by *The House of Mirth* (1905), peopled, like many of her subsequent novels and short stories, by the closed and artificial social world into which she herself had been born.

In 1907 Mrs. Wharton settled permanently in France. Her short novel *Ethan Frome*, a tragic love story of simple people in a bleak New England environment, was published in 1911. In the view of many critics, this book, because of its simplicity, has a universality lacking in her society novels. She subsequently produced a great number of novels, travel books, stories, and poems. Her other important novels include *The Custom of the Country* (1913), *The Age of Innocence* (1920; Pulitzer Prize, 1921), and four short novels collected in *Old New York* (1924). Four of her novels were made into successful plays by other writers.

Edith Wharton, who in 1924 became the first woman to receive an honorary degree from Yale University, viewed Victorian society with ironic detachment. Like her friend Henry James (see under JAMES), the American novelist whose writings strongly influenced hers, she was concerned in her works with the subtle interplay of emotions in a society that censured the free expression of passion. Her understanding of conflicting values in this artificial milieu often gives to her stories a tragic intensity.

WHEAT, common name for cereal grasses of the genus *Triticum*, cultivated for food since prehistoric times by the peoples of the temperate zones, and now the most important grain crop of those regions; see AGRICULTURE: History; CEREALS; GRASSES.

Wheat is a tall, annual plant attaining an average height of 4 ft. The leaves, which resemble those of other grasses, appear early and are followed by slender stalks terminating in spikes or so-called ears of grain.

Classification. Species of wheat are classified according to the number of chromosomes (see CHROMOSOME) found in the vegetative cell. The genus *Triticum* is divided into three series: the diploid, or einkorn, containing 14 chromosomes; the tetraploid, or emmer, containing 28 chromosomes; and the hexaploid, containing 42 chromosomes. The einkorn series contains the species *T. monococcum*, or einkorn, and *T. spontaneum*, or wild einkorn. Comprising the emmer series are *T. dicoccum*, or emmer; *T. dicoccoides*, or wild emmer; *T. durum*, or durum; and others. Five species constitute the hexaploid series: *T. spelta*, properly called spelta, but sometimes spelt; *T. aestivum*, common wheat; *T.*

Edith Wharton





Wheat heads and grains of a spring variety of common wheat, *Triticum aestivum*. J. C. Allen and Son

compactum, club wheat; *T. sphaerococcum*, shot wheat; and *T. macha*, macha wheat. Many of these species are grown in the United States for experimental purposes, but only varieties of common, club, and durum wheats are of commercial importance.

Varieties. According to the regions in which they are grown, certain types of wheat are chosen for their adaptability to altitude, climate, and yield. The common wheats grown in the Soviet Union, the U.S., and Canada are spring and winter wheats, planted either in the spring for summer harvest or in the fall for spring harvest. The color of the grain varies from one type to another; white wheats are mostly winter wheats, red are spring wheats. Closely related to the common wheats are the club wheats, which have especially compact spikes, and spelta (not grown in the U.S.), in which the glumes tightly enclose the grains. Durum wheat (Lat. *durum*, "hard") is so called because of the hardness of the grain. It is grown in north-central regions of the U.S. New high-yielding wheats were developed in the 1960's for use in the developing countries, and research on them was continuing in the 1970's.

Diseases and Planting Methods. Diseases of wheat are connected with parasitic fungi. The chief of these diseases are rust and smut (qq.v.); see also DISEASES OF PLANTS; FUNGI. Wheat is also liable to injury from several insect pests; a par-

ticularly important insect pest is the Hessian fly (q.v.).

In the U.S. wheat is usually planted by sowing machines of the drill or broadcast type; see AGRICULTURAL MACHINERY. Little cultivation is necessary beyond preparation of the land by plowing, harrowing, and, sometimes, dusting to control pests. Wheat crops are generally rotated with corn, hay, and pasture in the eastern U.S., and are rotated with oats and barley, or bare fallowing, in the drier western regions.

Uses. The main use of wheat is the manufacture of flour for bread and pastries. In general, hard varieties are used for bread flour, and soft varieties for pastry flour. Wheat is used also in the production of breakfast foods, and to a limited extent in the making of beer, whiskey, and industrial alcohol. Low grades of wheat, and by-products of the flour-milling, brewing, and distilling industries, are used as feed for livestock. A minor amount of wheat is used as coffee substitute, especially in Europe, and wheat starch is employed as a sizing for textile fabrics. See also BREAD; FLOUR; MACARONI.

History. Remains of both emmer and einkorn wheats have been found by archeologists working on sites in the Middle East dating from the 7th millennium B.C. Emmer was grown in predynastic Egypt; in prehistoric Europe it was grown in association with barley and einkorn and club wheats. Bread wheat (*T. aestivum*) was identified at a 6th-millennium site in southern Turkestan, and a hexaploid wheat was found at Knossos (q.v.) in Crete. The cultivation of wheat in the Americas was introduced by the Spaniards in Mexico and by the English in New England and Virginia.

Statistics. In the mid-1970's the U.S. annually produced about 12 percent of the world output of wheat. The Soviet Union was the world's largest producer; its output ranged from more than triple to about one and one half times that of the U.S. Nevertheless, because of weather conditions, the U.S.S.R. was forced to buy wheat from the U.S. and Canada in 1972 and 1975. The other large producers of wheat in the 1970's were Canada, China, India, and Turkey, and in Europe, France and Italy.

The leading wheat-producing States in the U.S. are Kansas, North Dakota, Washington, and Montana. In Canada, wheat farming is centered in Saskatchewan, Alberta, and Manitoba.

In 1974 and 1975, the following amounts were produced: by the U.S.S.R., 6,700,000,000 bu. and 4,600,000,000 bu.; by Canada, 485,360,000 bu. and 606,700,000 bu.; by the U.S., 1,793,300,000 bu. and 2,100,000,000 bu.

WHEATLEY, Phillis (1753–84), American poet, born in Africa. Captured by slave traders at the age of eight, she was brought to the American colonies and sold to a family living in Boston, Mass., whose name she later adopted. While serving as a maid-servant she showed an unusual facility with languages. She began writing poetry at age thirteen, using as models British poets of the time, especially Alexander Pope and Thomas Gray (qq.v.). In 1773 she accompanied a member of the Wheatley family to England, where she gained wide-spread attention in literary circles. She subsequently returned to Boston. Her best-known poems are "To the University of Cambridge in New England" (1767), "To the King's Most Excellent Majesty" (1768). The volume *Poems on Various Subjects: Religious and Moral* (1773) was published in London.

See also NEGRO LITERATURE; AMERICAN: 18th to late 19th Century.

WHEATON, city in Illinois, and county seat of Du Page Co. 25 miles w. of Chicago. Corn, oats, and barley are the chief agricultural crops of the surrounding area. In the city are Wheaton College (1860) and the birthplace and gravesite of the lawyer and industrialist Elbert Henry Gary (q.v.). Wheaton was settled about 1830 and incorporated in 1859. Pop. (1960) 24,312; (1970) 31,138.

WHEATON, unincorporated community of Maryland, in Montgomery Co., between Rock Creek and the Northwest Branch of the Anacostia R., 10 miles N. of Washington, D.C. Principally residential, the area has plants that manufacture chemicals, steel products, computers, automotive parts, furniture, and household equipment. Wheaton Regional Park includes an amusement park and botanic gardens. Pop. (1960) 54,635; (1970) 66,247.

WHEAT RIDGE, or WHEATRIDGE, city of Colorado, in Jefferson Co., on Clear Creek, adjoining Denver on the N.W. and 6 mi. from the city center. At its N.E. edge is the large Lakeside Amusement Park. Principally residential, the city has plants that manufacture glass and plastic products, electronic equipment, textiles, metal and machine products, construction equipment, and food products. Pop. (1960) 21,619; (1970) 29,795.

WHEATSTONE, Sir Charles (1802–75), British physicist and inventor, born in Gloucester, England. In 1816 he was apprenticed to his uncle, a musical-instrument maker in London, and in 1823 he inherited the business. During this phase of his career he invented the concertina, a kind of accordion (q.v.). In science he was

self-educated, conducting experiments in the fields of sound, light, and electricity (qq.v.). In 1834 he was appointed professor of experimental philosophy at the University of London, and in 1837, with the British electrical engineer Sir William Fothergill Cooke (1806–79), he patented the first British electric telegraph. Wheatstone later improved his telegraph by developing various types of recorders and a high-speed automatic transmitter. His invention was widely applied in the system of telegraphy used in Great Britain. See TELEGRAPH: *Historical Development*. The electrical instrument known as the Wheatstone bridge, although invented by the British scientist Samuel Hunter Christie (1784–1865), bears his name because he was the first to apply it for measuring resistance in electric circuits; see ELECTRIC CIRCUIT; ELECTRIC METERS: *Miscellaneous Measurements*. Wheatstone also invented the stereoscope (q.v.) and was a noted authority on cryptography (q.v.). He was knighted in 1868 and received many other honors.

WHEATSTONE BRIDGE. See ELECTRIC METERS: *Miscellaneous Measurements*.

WHEEL, circular frame or disk, constructed to revolve on a central axis, and constituting an integral feature of most ground conveyances. The earliest known wheels, constructed in ancient Mesopotamia (q.v.), date from about 3500 to 3000 B.C.; see ARCHEOLOGY: *Current Research: The Urban Revolution*. Wheeled vehicles are believed to have appeared after the invention of the potter's wheel (see POTTERY), and the wheeled cart soon replaced the sledge as a means of transportation (q.v.). In its most primitive form, the wheel was a solid wooden disk mounted on a round axle, to which it was secured by wooden pins. Eventually sections were carved out of the disk to reduce the weight, and radial spokes were devised about 2000 B.C. The invention of the wheel was a major turning point in the advance of human civilization. The wheel led to better utilization of animals, particularly oxen and horses, for agricultural and other work, and became an invaluable mechanical means for man to control the flow and direction of power or force. The applications of the wheel in modern life and technology are virtually infinite. See AUTOMATION; GEARING; MACHINE; PULLEY; WHEEL AND AXLE.

WHEEL AND AXLE, in mechanics, simple machine consisting of two concentric uneven sized wheels; see MACHINE; MECHANICS. In most applications, the smaller wheel of the two is the axle. The wheel and axle combines the effects of the pulley and the lever (qq.v.) by allowing for a redirection of the force applied through a

WHEELER

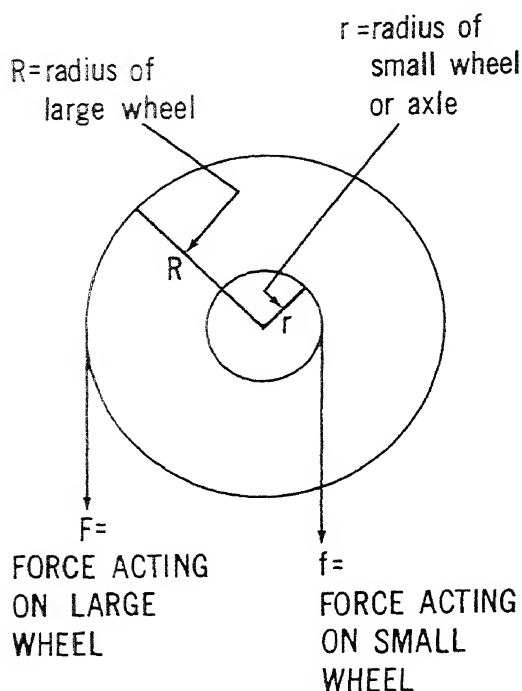


Diagram illustrating the principle of the wheel and axle.

rope or cable, and also for an increase or reduction in the magnitude of the force (q.v.). As illustrated on the diagram, the force applied to one wheel needed to balance the force applied to the other is inversely proportional to the radii of the two wheels. Wheel and axle combinations are employed in weightlifting machines, such as winches and capstans, and can also be used as parts of more complex machines. A special form of the wheel and axle combination occurs in a train of spur gears, such as in the gearing arrangement of a watch or clock; see **GEARING**.

F.La.

WHEELER, Burton Kendall (1882–1975), American senator and lawyer, born in Hudson, Mass. He was graduated from the law school of the University of Michigan in 1905, practiced law in Montana until 1910, when he was elected to the State legislature, and then served from 1913 to 1918 as United States district attorney for Montana. He was forced to resign the last office for refusing to prosecute copper mine workers and pacifists. In 1922 he won election to the United States Senate as a Democrat. He was the Vice-Presidential nominee of the Progressive Party (q.v.) in 1924, but rejoined the Democrats in 1928.

Wheeler served four terms in the Senate (1923–46). He supported the domestic programs

of President Franklin Delano Roosevelt (q.v.) with few exceptions, the most notable being in 1937, when he helped defeat the proposal to enlarge the Supreme Court of the United States (q.v.). In foreign affairs, he was a leading noninterventionist prior to the United States entrance into World War II, opposing several congressional acts that aided the Allied powers. He was defeated in the 1946 Senate primary election and resumed the practice of law.

WHEELER, Joseph (1836–1906), American military officer and politician, born in Augusta, Ga., and educated at the United States Military Academy. He resigned his commission in the United States Army in 1861 after the outbreak of the Civil War and joined the Confederate army. In 1862 he commanded a regiment at the Battle of Shiloh and became chief of cavalry in the Army of Tennessee. He played a prominent part in the battles of Chickamauga and Chattanooga in 1863 and in the defense of Atlanta (q.v.) in 1864. In 1864–65 Wheeler's cavalry was the primary hindrance to Union forces under General William Tecumseh Sherman (see under **SHERMAN**) in their advance through the Carolinas and march to the sea. See **CIVIL WAR**, **THE AMERICAN**, and separate articles on the battles mentioned.

After the war Wheeler became a lawyer and cotton planter in Alabama. He served as a Democrat from Alabama in the United States House of Representatives from 1881 to 1882, in 1883, and from 1885 to 1900. While in the House, he was a strong advocate of reconciliation between the North and the South. He became a major general of volunteers in the Spanish-American War (q.v.), leading a cavalry expedition to Cuba where he defeated the Spanish at Las Guásimas in June, 1898. During the Philippines insurrection in 1899–1900, he commanded a brigade; see **PHILIPPINES**, **REPUBLIC OF THE**; *History: American Cession*. Wheeler was commissioned brigadier general in the regular army in June, 1900, a few months before his retirement.

WHEELER, William Almon (1819–87), nineteenth Vice-President of the United States, born in Malone, N.Y., and educated at the University of Vermont. He was admitted to the bar in 1845 and was a member of the New York State legislature from 1850 to 1859. From 1861 to 1863 and from 1869 to 1877 he served in the United States House of Representatives. While serving in the House, Wheeler formulated an agreement to settle differences between contending political factions in a disputed 1874 Louisiana election. This so-called Wheeler Compromise prevented the breakdown of the Louisiana legislature. Wheeler was the running mate of the Repub-

lican candidate Rutherford B. Hayes (q.v.) in the Presidential election of 1876. Designated Vice-President by the Electoral Commission of 1877 (q.v.), he held office for one term.

WHEELING, city in West Virginia, and county seat of Ohio Co., on the E. bank of the Ohio R., about 45 miles S.W. of Pittsburgh, Pa. It is the principal manufacturing center and third-largest city in population in the State and lies in a region rich in coal and natural gas. Steel manufacturing is the leading industry. Wheeling is also an important center for the manufacture of glass, pharmaceutical products, toys, food products, electrical equipment, enamel ware, stone, clay, and aluminum products, clothing, and paper goods. Linsly Institute of Technology (1814) and Mount de Chantal Academy for Girls (1848) are among the educational institutions. The municipal park system includes Oglebay Park, covering 754 acres on the outskirts, with extensive recreational facilities; other features of the park are a museum of natural history and the Mansion Museum, dating in part from 1801 and containing collections of art and historical material.

Wheeling was first settled in 1769 and was the site of Fort Henry (1776), an important outpost of the Virginia frontier named in honor of the American Revolutionary leader Patrick Henry (q.v.). Fort Henry was attacked frequently by Indian and British forces during the American Revolution (q.v.). Wheeling was incorporated as a town in 1806 and chartered as a city in 1836. Overland and river traffic added rapidly to its importance, and in 1852 it became a railroad terminus. In 1861, when Virginia seceded from the Union, Wheeling became the center of the opposition to secession and was named capital of the "Restored Government of Virginia", which became the State of West Virginia in 1863. It was the capital of the State until 1869 and again from 1875 to 1885. Pop. (1960) 53,400; (1970) 48,188.

WHELK, common name applied to numerous species of marine gastropods which belong to the family Buccinidae; see GASTROPODA. The common northern whelk; *Buccinum undatum*, has a thick, spiral shell, usually from about 3 to 6 in. in length, with a wide aperture and ridged whorls. It is active and carnivorous, feeding on living or dead animals, which it grasps with its foot. The mouth is located at the end of a large proboscis, and the radula, or tongue, is toothed and capable of boring holes in the shells of other mollusks on which the whelk preys. Common along the northern coasts of the North Atlantic Ocean, the whelk occurs from the low-water mark to a depth of 600 ft. Several hundred

eggs are laid in individual capsules; the latter are attached to each other, forming spongelike masses. In many European countries the whelk is used for food. See also CONCH.

WHIG, member of a former British political party, traditionally in opposition to the Tory Party (see TORY), or of the Whig Party (q.v.) of the United States. The name is probably derived from Whiggamore, a derogatory term first applied to the Covenanters (q.v.) of 17th-century Scotland, supporters of Presbyterianism (q.v.).

Later in the 17th century the Whig Party of England emerged in opposition to King Charles II (q.v.) and to the accession of the Roman Catholic duke of York as James II (q.v.). The party was largely responsible for the Glorious Revolution of 1688, which established the supremacy of Parliament over the king. Backed by the growing British mercantile and industrial interests, the landed but untitled gentry, and the Protestant dissenters, or nonconformists (q.v.), the Whig Party achieved control of the government in 1714 on the accession of King George I (q.v.). For nearly fifty years the Whigs remained in power, until in 1760 the opposition Tory Party rode a wave of conservative sentiment into office. During this period, those American colonials who supported the American Revolution (q.v.) were known as Whigs.

For seventy years the Whig Party was in the minority in Great Britain. In 1830, however, their reform platform won popular support and they were returned to office. During the next few years they passed important reform legislation; see REFORM BILLS. At the same time, the Whig Party became known as the Liberal Party (q.v.) and the Tory Party as the Conservative Party (q.v.).

See ENGLAND: *History: Charles II; The Glorious Revolution*; GREAT BRITAIN: *History: Strife between Whigs and Tories*.

WHIG PARTY, in United States history, one of the two dominant political parties in power from the mid-1830's to the mid-1850's. The party was formed about 1834 by members of the defunct National Republican Party and others opposed to the policies of President Andrew Jackson (q.v.). It was composed of many factions, united only in their opposition to the Democratic Party (q.v.).

The Whig Party nominated three unsuccessful candidates for President in the election of 1836. In 1840 the Whig ticket consisted of the statesmen William Henry Harrison for President and John Tyler (qq.v.) for Vice-President. The Whigs triumphed, but Harrison died after one month in office, and Vice-President Tyler, who

WHIG PARTY

had been a Jacksonian Democrat, acceded to the Presidency. Tyler shortly embittered the Whigs by vetoing the bills with which they had meant to restore the Bank of the United States, abolished by Jackson; see **BANKS AND BANKING: United States Banking System**. Most of Tyler's cabinet immediately resigned in protest and his membership in the party was withdrawn.

In 1844 the Whig Party, whose leaders were the statesmen Daniel Webster and Henry Clay (qq.v.), nominated Clay for President. In the ensuing campaign Clay refused to take a definite stand on the Texas annexation issue. This provoked Northern abolitionists (q.v.), who opposed the admission of Texas to the Union as a slave State, to support the Liberty Party (q.v.) candidate. The Whig split ensured victory for the Democratic candidate James Knox Polk (q.v.). See **TEXAS: History**.

Once the Mexican War (q.v.) had been declared, controversy over admitting or excluding slavery from territory gained in the war further splintered the party; see **WILMOT PROVISIO**. Anti-slavery Whigs, known as Conscience Whigs, in Massachusetts opposed the so-called Cotton Whigs in the proslavery States. Despite the dissension, the Whig Party, with the popular general Zachary Taylor (q.v.) as its candidate, was successful in the Presidential election of 1848. A temporary reconciliation between the party factions was effected when the Southern Whigs sided with the Unionists against secession in 1850; see **COMPROMISE MEASURES OF 1850**. By 1852, however, the party was widely split again by sectional allegiances. The election of 1852 resulted in the overwhelming defeat of the Whig candidate, General Winfield Scott (q.v.).

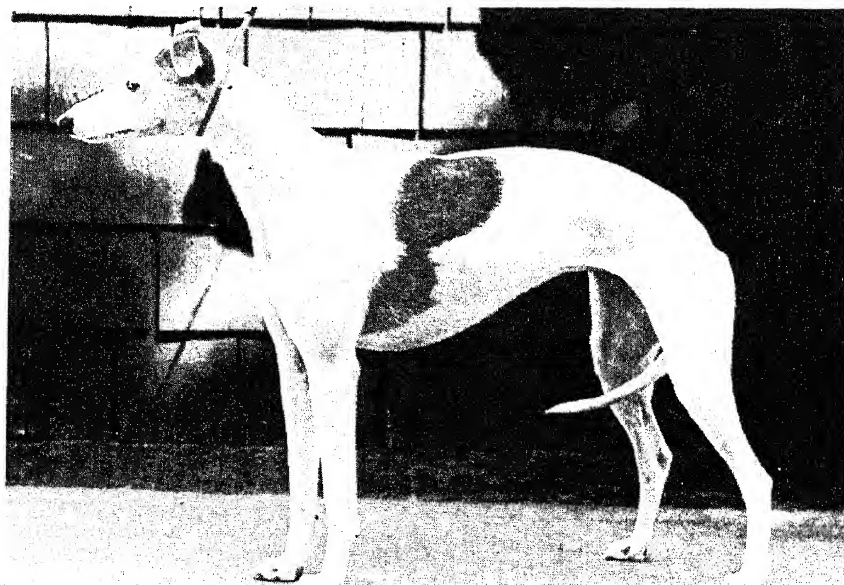
The question of slavery within the new terri-

tories of Kansas and Nebraska in 1854 led to the complete disruption of the Whig Party and to the formation of a new party, the Republican Party (q.v.), in the North; see **KANSAS-NEBRASKA ACT**. Most Northern Whigs, many of whom were at first affiliated with the so-called Know-Nothing movement (see **KNOW-NOTHING**), joined the new party. In the South most of the Whigs were soon absorbed by the Democratic Party.

See also **POLITICAL PARTIES IN THE UNITED STATES: Revived Two-Party System**; **UNITED STATES OF AMERICA: History: The Growth of the Nation: The Rivalry between Sectional Interests**. For the meaning of the term during the American Revolution (q.v.), see **WHIG**.

WHIPPET, breed of hound or sporting dog that hunts by sight, not by scent. The breed originated in England in the early 19th century from a cross between the English greyhound and various breeds of terriers, the product of which was later crossed with the Italian greyhound (q.v.); see **GREYHOUND**; **TERRIER**. The whippet was first recognized as a show breed in 1891. The dog was formerly used as a rat killer and for rabbit coursing, but currently is valued as a pet and for racing. The whippet is among the speediest domestic animals, being able to run as fast as 35 m.p.h.

Although delicate and almost fragile in appearance, the whippet is a strong and vigorous animal. The dog has a long, lean head, fairly wide between the ears; small, finely textured ears, thrown back and folded; intelligent eyes, dark hazel in color; a long, muscular neck; a deep and wide chest; long, tapering legs; powerful hindquarters; and a long, tapering tail. It has a smooth, firm coat, which may be of any of a number of colors. The whippet weighs about



Whippet

Gaines Dog Research Center

20 lb.; the male is between 19 and 22 in. in height and the female between 18 and 21 in.

WHIPPLE, George Hoyt (1878–1976), American pathologist, born in Ashland, N.H., and educated at Yale and Johns Hopkins universities. He taught at Johns Hopkins University from 1909 to 1914, when he left to become professor of medicine at the University of California. From 1921 to 1955 he was professor of pathology at the School of Medicine and Dentistry of the University of Rochester; he served also as dean of the school until 1953.

Whipple shared the 1934 Nobel Prize in medicine and physiology with the American physicians George Richards Minot and William Parry Murphy (qq.v.). Early research by Whipple proved that a diet of liver helped restore red blood cells in anemic dogs. Minot and Murphy utilized this research in their work on pernicious anemia in man; see ANEMIA.

WHIPPLE, William (1730–85), American Revolutionary patriot and soldier, born in Kittery, Maine. For a number of years he was a ship's captain engaged in the African slave trade. He then settled as a merchant in Portsmouth, N.H., and became active as a patriot. A member of the Continental Congress from 1776 to 1779, he was one of the signers of the Declaration of Independence (qq.v.). During the American Revolution (q.v.) he served with the New Hampshire militia and was one of the commanding officers in the Saratoga campaign in 1777; see SARATOGA, BATTLES OF. He was an associate justice of the superior court of New Hampshire from 1782 until his death.

WHIPPOORWILL, common American bird, *Caprimulgus vociferus*, of the goatsucker family, Caprimulgidae, noted and named for its *whippoorwill* call. It is about 10 in. long, and has a wide mouth, fringed with bristles, and mottled gray, brown, and black plumage. A nocturnal bird, the whippoorwill rests by day lengthwise on a branch or on dry fallen leaves. By virtue of its protective coloration, it is thus rarely seen. By night it feeds on moths, beetles, and other insects caught on the wing. After dark, during the breeding season, it calls with great persistence. The female lays two brown-speckled, white eggs among dry leaves in a slight depression in the ground.

The whippoorwill breeds from Manitoba east through southern Canada and south to Arizona, Texas, Arkansas, and South Carolina. It winters from the southern United States to Costa Rica.

WHIRLIGIG BEETLE. See WATER BEETLE.

WHIRLPOOL, body of water spinning in a generally circular motion, often around a central

depressed area and occasionally around a vortical cavity that draws surrounding floating objects toward the center. Whirlpools at sea are caused by the meeting of opposing currents and tides, by ocean currents striking offshore rocks and against certain coastal configurations, and by the force of wind acting upon water; see TIDES; WIND. Irregularities in basin and channel bottoms usually cause whirlpools in rivers and lakes.

Whirlpools in the open seas are giant suctionless eddies, such as the Sargasso Sea in the Atlantic Ocean (q.v.), and pose no threat to modern shipping. Earlier sailing ships, however, were sometimes becalmed in them and were held fast in their centers or were swept by the slowly rotating currents against rugged coasts. Whirlpools with a strong vortical motion, on the other hand, can become very violent and are capable of sucking boats into their rapidly downspiralizing cavities. Noted whirlpools include the Charybdis (see SCYLLA AND CHARYBDIS) in the Strait of Messina between mainland Italy and the island of Sicily, the Maelstrom in the Lofoten Islands off Norway, and the Whirlpool Rapids below Niagara Falls (q.v.).

WHIRLWIND, any rotating air mass, including the tornado (q.v.) and the large cyclonic and anticyclonic storms; see CYCLONE. In meteorology (q.v.), the term "whirlwind" is more strictly applied to the smaller swirling atmospheric phenomenon commonly known as dust devil or dust whirl, which occurs mostly over deserts and semiarid plains during hot, calm days. The principal cause of whirlwinds is intense insolation, or incoming solar radiation received by the earth, which produces an overheated air mass just above the ground. This air mass rises, usually in the form of a cylindrical column, sucking up loose surface material, such as dust, sand, and leaves. Whirlwinds vary in height from 100 to 300 ft., but exceptionally vigorous dust devils may exceed 5000 ft. in height. The vortices of the whirlwinds range in size from a few yards to several hundred feet, and depending on their force and size, dust devils may disappear in seconds or last several hours. Brief whirlwinds are erratic in motion, but the longer-lasting ones move slowly with the prevailing winds. See WIND.

Water whirlwinds, commonly called waterspouts, are whirling columns of air and watery mist. The mist is mainly fresh water, formed by condensation in the atmosphere (q.v.). Water whirlwinds are frequent occurrences over oceans and lakes but are seldom violent. Convective storms generate most waterspouts, and

WHISKEY

the rare tornadic spouts are generated in thunderstorms, in association with tropical cyclones or cold frontal squalls. Fire and smoke whirlwinds are caused by forest, oil, and incendiary bomb fires, and may have large, violent vortices.

Dust and fire whirlwinds are reported in the Old Testament, notably in the book of Job (q.v.). The Greek philosopher Aristotle (q.v.) attempted to explain whirlwinds in his *Meteorologica*, a study of meteorological phenomena.

WHISKEY or WHISKY (Gael. *uisge beatha*, "water of life"), alcoholic liquor distilled from the fermented mash of cereal grains, usually with one type of grain, such as barley, rye, corn, or wheat, predominant. Essentially, whiskey consists of an alcoholic distillate diluted to palatable strength with water. The characteristic taste and aroma associated with each variety of whiskey are conferred by certain substances produced during the manufacturing process. The alcoholic strength of whiskey is measured by a standard known as proof, a figure representing twice the volume percentage of alcohol. Thus, 160 proof whiskey contains 80 percent alcohol by volume. Proof varies with the degree of distillation and with the amount of water used for dilution. The principal kinds of whiskey are Scotch and Irish whiskeys, which are the products respectively of Scotland and Ireland, and Canadian, Bourbon, and rye whiskeys, which are distinctively American types.

Production. The whiskey-manufacturing process, though differing in certain respects according to local custom and the individual distillery, always includes four basic steps, namely mashing, fermentation, distillation, and aging. **MASHING.** In the mashing stage, the grain first is soaked in hot water and crushed. A small amount of malt is then added to the resultant mash, known technically as the wort. The enzyme diastase, a part of the malt, converts the starch of the grain into sugar. Clear water, free from organic matter and containing the proper mineral compounds, and sound, fully matured grain are the key ingredients of a good mash. Some distillers of fine whiskeys, convinced that grain and water should originate in the same type of soil, use only locally grown grain.

FERMENTATION. The process of fermentation (q.v.) converts sugar into alcohol under the influence of enzymes (q.v.) produced by certain types of fungi. In the preparation of whiskey, fermentation is initiated in the wort by the introduction of yeast, usually of the genus *Saccharomyces*; see **FUNGI: Industrial Fungi**. The fermentation period must be precisely calculated, and many factors requiring expert knowledge must be

taken into account, including the selection of the most suitable species of yeast.

The fermented wort contains, in addition to the alcohol, solid particles originating from the grain, yeast, and mineral salts, and such secondary fermentation products as glycerol, lactic acid, tartaric acid, and fatty acids. Some of the by-products of fermentation contribute to the taste and aroma of the final product.

DISTILLATION. In the process of distillation (q.v.) the alcohol and the desirable fermentation by-products are separated from the fermented wort. Distillation equipment used in whiskey production varies from primitive pot stills, employed traditionally in the production of Scotch whisky in the Highlands, to the modern continuous, or column, stills, which are used by United States distillers. Various degrees of distillation are achieved by a number of methods, including the use of either single or double distillation, the elimination of undesirable secondary products by means of separate distilling columns, and rectification, or purification, in multichambered rectifying columns. The strength and purity of the whiskey are determined by the skill with which distillation is accomplished. See **DISTILLED LIQUORS**.

AGING. In order to make whiskey palatable, to provide the desired appearance, and to improve the aroma and taste, a very carefully controlled process of maturation is required. The colorless and raw distilled spirits are stored in specially treated casks or barrels and left undisturbed for a period ranging from two to eight years, and sometimes longer.

During maturation, whiskey undergoes definite changes in aromatic and taste characteristics. The changes are caused by three major types of chemical reaction: the extraction of complex wood substances by the alcohol; the oxidation of the original organic substances in the distillate and of the extracted wood substances; and the formation of new products as a result of the interaction between various organic substances in the distillate.

Some of the substances extracted from the wood impart to the whiskey its characteristic color. To a large extent the latter depends upon the type of cask or barrel used for maturation. Barrels that formerly held sherry or other wines contribute subtly different tints and flavors to the whiskey. When charred oak barrels are employed, as in the aging of U.S. whiskeys, substances extracted from the charred portions of the staves give the liquor a deep reddish-brown tone.

Prolonged aging is a key factor in the pro-

duction of fine mellow whiskey. Methods designed to hurry the aging process invariably have proved unsuccessful.

Imported Whiskeys. Scotland, Ireland, and Canada each produce distinctive whiskeys that are imported into the U.S. Historically, Scotland and Ireland made whiskeys as early as the 12th century whereas American whiskey production developed in the early 18th century. The liquor is spelled whisky in Scotland and Canada, and whiskey in the U.S. and Ireland.

SCOTCH WHISKY. Commercially distributed varieties of Scotch whisky, a type distinguished from all others by its smoky flavor, are blends of spirits distilled in the Highlands with spirits distilled in the Lowlands. The smoky flavor is imparted to the blends by the Highland spirits. The distillers achieve this characteristic flavor by using pot stills and malted barley that has been cured over open peat fires. Unmalted barley and column stills are used in the production of Lowland Scotch. Both the Highland and Lowland spirits are aged in sherry barrels. Blending takes place when the component whiskeys are approximately three or four years old, and the blend itself then is further aged.

IRISH WHISKEY. Although Irish whiskey is produced by methods similar to those employed in Scotland, it lacks the smoky flavor characteristic of Scotch. The difference results mainly from the fact that, in the curing process, the malt is shielded from contact with smoke.

CANADIAN WHISKY. Canadian whisky, made exclusively in Canada, is a light-bodied type distilled usually from a mash of cereal grains, corn, rye, and barley malt. The spirits are drawn from the still at a much higher proof than other American varieties; as a consequence Canadian whisky contains fewer flavoring ingredients.

Domestic Whiskeys. Bourbon and rye are manufactured only in the U.S. Bourbon is made from a mash containing at least 51 percent corn; rye whiskey, as the name suggests, is made from a mash consisting predominantly of rye grain. The aging period for U.S. whiskeys ranges from two to eight years. New barrels of seasoned white oak which have been well charred on the inside are used in the aging process.

A straight whiskey is pure rye or Bourbon, that is, an unblended whiskey. Bourbon is the most popular American straight whiskey. In the U.S., a blended whiskey is produced by combining straight whiskey, which must have been aged for a minimum of two years, or a mixture of straight whiskeys, with neutral grain spirits. Some of the flavor and color are lost in this process, but there is no dilution of alcoholic

content. Caramel or blended wines are added to the blend to restore the color, and sometimes harmless flavorings also are used.

In addition to blends, bonded whiskeys are produced in the U.S. Bonded whiskey is either 100 proof rye or Bourbon, either of which has been aged for at least four years in a government warehouse. The age of "bottled in bond" whiskey is attested by a Federal stamp attached to the stopper.

A completely new type of whiskey, called light whiskey, became available to the public in the early 1970's. It is distilled from the same mash of corn, rye, and barley used for Bourbon, but it is taken off the still at 180 proof and redistilled with the same equipment used in making vodka, then stored in oak barrels for a minimum of four years. It is similar to Scotch and Canadian whiskeys but is still a distinctly American whiskey.

See also DISTILLED LIQUORS; PROHIBITION.

DISTILLED SPIRITS INSTITUTE

WHISKEY REBELLION or **WHISKEY INSURRECTION**, in United States history, a series of disturbances in 1794 aimed against enforcement of a Federal law of 1791 imposing an excise tax on whiskey. The burden of the tax, which had been sponsored by the Federalist leader and secretary of the treasury Alexander Hamilton (q.v.), fell largely upon western Pennsylvania, then one of the chief whiskey-producing regions of the country; see **FEDERALIST PARTY**. The grain farmers, most of whom were also distillers, depended upon whiskey for almost all their income, and considered the law an attack on their liberty and economic well-being. Organized resistance to the tax, even including the tarring and feathering of Federal revenue officials, rapidly assumed grave proportions. Warrants for the arrest of a large number of noncomplying distillers were issued by the Federal authorities in the spring of 1794, and in the riots that followed a Federal officer was killed. In a proclamation issued in August, 1794, President George Washington (q.v.) ordered the insurgents to disperse and requested the governors of Pennsylvania, Maryland, New Jersey, and Virginia to mobilize contingents of militia. The President also dispatched three commissioners to Park-inson's Ferry, Pa., to negotiate with delegates representing the western section of the State, but the negotiations proved fruitless. On Oct. 14, 1794, Washington ordered the militia to proceed to the western counties. They met little resistance. The troops seized a number of people, most of whom were soon released for want of evidence. Two offenders were convicted of

WHISKEY RING, THE

treason (q.v.), but they were pardoned by Washington.

The so-called Whiskey Rebellion is important in U.S. history mainly because it provided the first real test of the Federal government's prerogatives and law-enforcement power, including the President's right to command the use of State militias.

WHISKEY RING, THE, in United States history, secret association of distillers and Federal officials that operated during the administration of President Ulysses Simpson Grant (q.v.) to defraud the government of the excessively high tax imposed on distilled spirits. Tax abatements were shared between distillers and tax collectors, and newspapermen, storekeepers, and officials of various kinds were bribed. Although the conspiracy was public knowledge, the political importance of those involved protected them from prosecution until the secretary of the treasury Benjamin Helm Bristow (q.v.) employed secret investigators to gather evidence. On May 10, 1875, at Bristow's direction, sixteen distilleries in Saint Louis, Milwaukee, and Chicago were seized, and indictments were promptly procured against about 240 distillers and revenue officials and against Orville E. Babcock (1835-84), private secretary to the President. Babcock was acquitted through the influence of the President, but 110 of those indicted were found guilty. The leaders among those convicted, however, were pardoned after a short interval. The allegation, made at the trials, that the illegal abatement of taxes had been for the purpose of increasing the campaign funds of the Republican Party created a major political scandal.

WHISKEYTOWN-SHASTA-TRINITY NATIONAL RECREATION AREA, recreation area near Redding, Calif., divided into three separated units. The 3250-acre Whiskeytown unit, administered by the National Park Service (q.v.), is 8 miles w. of Redding and includes Whiskeytown Reservoir. The Shasta unit and the Trinity-Lewiston unit are administered by the Forest Service of the United States Department of Agriculture. The 12,860-acre Shasta unit is on the Sacramento R. 10 miles n. of Redding, surrounding Shasta Lake. The 83,500-acre Trinity-Lewiston unit, on the Trinity R., 40 miles w. of Redding, surrounds Lewiston and Clair Engle lakes. All three units originated as part of a United States Bureau of Reclamation irrigation and electric-power system called Central Valley Project. The area has facilities for hunting, fishing, horseback riding, camping, picnicking, swimming, and other water sports.

WHIST, game of cards played by two sets of partners, using a full pack of fifty-two cards. The object of the game is to win as many of the thirteen so-called tricks as possible. The cards are dealt one at a time, face down, to all four players; the last card, which is the dealer's, is dealt face up to determine the trump suit for that hand. The player on the dealer's left leads, that is, plays any card; the other players in turn then play a card of the same suit. The player playing the highest card of the suit wins the trick and makes the first lead of the next trick. If, however, a player has no card of the suit led, he may play a card of the trump suit, which automatically outranks any card of the suit led and wins the trick. When more than one player plays a trump card, the highest trump wins the trick. Partners score one point for every trick over the first six that they take, and a game consists of seven points.

Variations of whist include bid whist, duplicate whist, and solo whist.

Whist, which until the late 17th century was called triumph or trump, is probably of English origin; as triumph it can be traced back as far as the early 16th century. The game became a preoccupation of fashionable society after the publication in 1742 of *A Short Treatise on the Game of Whist* by the British writer on games Edmond Hoyle (q.v.). The outstanding authority on whist was the British writer and physician Henry Jones (1831-99), who wrote on whist under the pen name of Cavendish. Whist underwent many changes during the 19th century, eventually evolving into the game of bridge (q.v.).

WHISTLER, James Abbott McNeill (1834-1903), American painter and etcher, born in Lowell, Mass. He entered the United States Military Academy in 1851, did not do well in his studies, and left in 1854 to take a job as a draftsman with the United States Coast Survey. One year later, he left the U.S. never to return, and went to Paris, where he became a pupil of the Swiss classicist painter Charles Gabriel Gleyre (1808-74). Formal instruction influenced him less, however, than his acquaintance with the French realist painter Gustave Courbet (q.v.), other leading contemporary artists, and his own study of the great masters and of the Japanese art then coming into vogue in Paris.

In Paris Whistler won recognition as an etcher, when his first series of etchings, "Twelve Etchings From Nature" (commonly called "The French Set"), appeared in 1858. Soon after, he moved to London, where his paintings, hitherto rejected repeatedly by the galleries of Paris,



"Arrangement in Black and Grey No. 1: The Artist's Mother" by James Whistler.
Louvre

found acceptance. "At the Piano", his first accepted painting, was shown by the Royal Academy of London in 1860. In 1863 his painting "The White Girl" won great acclaim in Paris. Thereafter exhibitions of his work aroused increasing international interest.

Three of Whistler's best-known portraits, "Arrangement in Black and Grey No. 1: The Artist's Mother" (Louvre, Paris), "Arrangement in Grey and Black No. 1: Thomas Carlyle" (City Art Gallery and Museum, Glasgow), and "Harmony in Grey and Green: Miss Cicely Alexander" (Tate Gallery, London) were painted in 1872. In 1877 he exhibited a number of landscapes done in the Japanese manner; these paintings, which he called "nocturnes", outraged conservative art opinion. The British art critic John Ruskin (q.v.) wrote a caustically critical article, and Whistler, charging slander, sued Ruskin for damages. He won the case, one of the most celebrated of its kind, but the expense of the trial forced him into bankruptcy. Selling the contents of his stu-

dio Whistler left Britain, worked intensively for a year (1879-80) in Venice, then returned to England and resumed his attack on the academic art tradition.

In later years Whistler devoted himself increasingly to etching, dry point, lithography, and interior decoration (qq.v.). "The Thames Series" (completed in 1860, first published in 1871), the "First Venice Series" (1880), and the "Second Venice Series" (1881) heightened his standing as an etcher. The Peacock Room, executed for a private London residence and now in the Freer Gallery of Art, Washington, D.C., is the most noteworthy example of his interior decoration.

Whistler came to be regarded toward the end of his life as a major artist. His importance as a painter stems from his assimilation of Japanese art styles, from his technical innovations, and from his championing the modern art move-

WHITE

ment. Many critics regard him as preeminent among etchers.

WHITE, river of Arkansas. It rises about 50 miles s. of the Arkansas-Missouri line, flows n. into Missouri, then turns s.e. and continues to the s.e. corner of Arkansas County, Ark., where the channel divides, one stream entering the Arkansas R. and the other the Mississippi. The tributaries are the Cache, Little Red, Black, Buffalo, James, and Norfolk rivers. The White is 685 mi. long.

WHITE, river in Indiana, chief tributary of the Wabash R. It is formed by the confluence of the e. and w. branches and has a total length of 350 mi. The river is navigable only to Martinsville, some distance below Indianapolis, and the e. branch is navigable to Rockford.

WHITE, tributary of the Missouri R. It rises in n.w. Nebraska, and, after a course through South Dakota, empties into the Missouri near Oacoma. It flows through the Badlands (q.v.); it is 507 mi. long.

WHITE, Byron Raymond (1917–), American jurist, born in Fort Collins, Colo. He received his bachelor's degree from the University of Colorado in 1938 and his degree in law from Yale University in 1946. He was a Rhodes scholar at the University of Oxford in 1939. His studies there were interrupted by the outbreak of World War II, in which White served with the United States Navy from 1942 to 1946. He had, meanwhile, played professional football in 1938–39 and from 1940 to 1942 during his studies at Yale. After the war he finished his legal education and served as law clerk to Chief Justice of the United States Frederick Moore Vinson (q.v.) in 1946–47. White practiced law in Denver, Colo., from 1947 to 1961, specializing in corporation law. President John F. Kennedy (q.v.), for whose election he had worked in 1960, appointed White deputy attorney general of the U.S. in 1961 and associate justice of the Supreme Court of the United States (q.v.) in 1962. On the bench, he usually votes with the majority. In 1971 he was one of the justices who upheld the right of the press to publish without prior restraint in the government's unsuccessful attempt to prevent publication of the so-called Pentagon papers. (see UNITED STATES: *History: World War II and Postwar Problems: The Nixon Administration*).

WHITE, Edward Douglass (1845–1921), American jurist, born in Lafourche Parish, La., and educated at Jesuit College, New Orleans, and Georgetown University. He fought with the Confederate army during the American Civil War, studied law, and was admitted to the Loui-

siana bar in 1868. A State senator from 1874 to 1878, he served on the Louisiana supreme court in 1879 and 1880. He was a Democratic member of the United States Senate in 1891–94, until President Grover Cleveland (q.v.) appointed him to the Supreme Court of the United States (q.v.). In 1910 White was made chief justice of the U.S. by President William Howard Taft (q.v.), becoming the first Southerner to hold that office since Roger Brooke Taney (q.v.). Many of White's judicial opinions, especially those relating to antitrust legislation, were of fundamental importance; see TRUSTS. In 1897 he formulated the so-called rule of reason, which held that the Sherman Antitrust Act (q.v.) of 1890 applied only to those combines and companies that exercised a degree of restraint upon trade and commerce that could be characterized as unreasonable. The rule of reason was applied in the Supreme Court majority opinion, written by him in 1911, that dissolved the Standard Oil Company of New Jersey and the American Tobacco Company; see STANDARD OIL COMPANY (NEW JERSEY). Although White generally upheld the Federal government in antitrust cases, his rule of reason weakened enforcement of the antitrust act. Another famous majority opinion written by him, in *Wilson vs. New, March*, 1917, affirmed the constitutionality of the Adamson Act (1916), which established the eight-hour day for the nation's railroad workers.

WHITE, E(lwyn) B(rooks) (1899–), American writer, born in Mount Vernon, N.Y., and educated at Cornell University. He joined the staff of the newly founded *New Yorker* magazine in 1926 and remained a regular contributor. From 1938 to 1943 he was also associated with *Harper's* magazine, for which he wrote the widely read monthly column "One Man's Meat". White's humorous essays and sketches satirized the complexities and difficulties of modern civilization and his light verse was notable for wit and perfection of form. In 1960 he received the gold medal for essays and criticism of the American Academy of Arts and Letters, and in 1963 he was awarded the United States Presidential Medal of Freedom. Besides his verse, his writings include the collected essays *One Man's Meat* (1942; rev. ed., 1944) and *The Points of My Compass* (1962); the children's fiction *Stuart Little* (1945), *Charlotte's Web* (1952), and *The Trumpet of the Swan* (1970); and a tribute to New York City, *Here Is New York* (1949).

WHITE, Patrick Victor Martindale (1912–), Australian author, born in London, England, and educated at the University of Cambridge. Taken to Australia as an infant, he went to school in

England and served in the Royal Air Force during World War II. His first novel, *Happy Valley* (1939), was set in Australia, as were such later successful works as *Voss* (1957), *Riders in the Chariot* (1961), and *The Eye of the Storm* (1973). White, the first Australian to be awarded the Nobel Prize in literature (1973), was cited for his "epic and psychological narrative art which has introduced a new continent into literature". His use of English has been praised by critics for its power and nuances.

WHITE, Paul Dudley (1886–1973), American cardiologist, born in Roxbury, Mass., and educated at Harvard University, at which he received an M.D. degree in 1911. He was clinical professor of medicine at Harvard from 1914 to 1956, during which time he pioneered in electrocardiography and gained a worldwide reputation as an authority on the diseases of the heart. White made a number of trips to foreign countries as head of teaching missions sponsored by the United States government. In September, 1956, when President Dwight David Eisenhower (q.v.) suffered a coronary thrombosis, White was named to head a team of heart specialists attending the President. White is the author of the standard work *Heart Disease*, of which several revised editions have been issued since its first publication in 1931, and of *Hearts: the Long Follow-up* (1967). He received the Distinguished Service Award of the American Medical Association in 1952.

WHITE, Peregrine (1620–1704), first English child born in New England, delivered on the *Mayflower* (q.v.) as it lay at anchor in present-day Cape Cod Bay, Mass. In 1621 his widowed mother married Edward Winslow (see under WINSLOW), later governor of Plymouth Colony (q.v.). White held a number of minor government posts during his lifetime.

WHITE, Stanford (1853–1906), American architect, born in New York City. White became an apprentice in the Boston, Mass. offices of the noted American architect Henry Hobson Richardson (q.v.) in 1872 and later, as Richardson's chief assistant, helped design Trinity Church, Boston. In 1879 he joined a New York City architectural firm subsequently known as McKim, Mead, and White. Notable structures designed by White that are still standing include the Boston Public Library; the Washington Arch in Washington Square Park, the Century Club, various buildings of New York University in New York City; and many private residences.

White specialized in modern adaptations of older styles, notably that of the Italian Renaissance. Most of the public buildings erected in

the United States during the 1890's and early 1900's reflect the influence of his designs; see AMERICAN ARCHITECTURE: *Era of Expansion: The Age of Splendor*.

White was shot and killed on the roof of Madison Square Garden by the Pittsburgh millionaire Harry Kendall Thaw (1871–1947). The murder, one of the most sensational in the annals of U.S. society, resulted from the discovery by Thaw that his wife, the actress Evelyn Nesbit (1885–1967), had been involved in a love affair with White.

WHITE, Walter Francis (1893–1955), American Negro leader and writer, born in Atlanta, Ga., and educated at Atlanta University. He was appointed assistant secretary of the National Association for the Advancement of Colored People (q.v.), or N.A.A.C.P., in 1918, and thereafter was active in investigating race riots and lynchings and in championing victims of racial injustice. White was executive secretary of the association from 1931 until his death. President Franklin Delano Roosevelt (q.v.) drew upon the experience of White and the N.A.A.C.P. when he established a fair employment practices committee in 1941. In 1945 White acted as consultant to the United States delegation at the organizational meeting of the United Nations (q.v.) in San Francisco. He wrote the novel *Fire in the Flint* (1924) and an autobiography, *A Man Called White* (1948).

WHITE, William Allen (1868–1944), American journalist, known as the sage of Emporia, born in Emporia, Kans., and educated at the University of Kansas. He bought the Emporia *Gazette* in 1895 and edited it until his death. Under his guidance, the small-town newspaper became known throughout the country. His editorial "What's the Matter with Kansas" (1896), an impassioned attack on Populism (q.v.), brought him fame and helped the Republican candidate William McKinley defeat the Democratic candidate William Jennings Bryan (qq.v.) for the Presidency. White was regarded thereafter as the authentic voice of so-called grass-root sentiment in the Midwest.

In 1912 White joined President Theodore Roosevelt (q.v.) in forming the first Progressive Party (q.v.). White ran as an independent Republican for the governorship of Kansas in 1924 but was defeated. Although he never held major public office, he exerted considerable political influence, acting as the spokesman both for small-town interests and for a broad and generous internationalism.

In addition to volumes of his collected editorials, notably *Forty Years on Main Street* (1937),

WHITE ANTS

White published a collection of short stories, *In Our Town* (1906); novels, including *A Certain Rich Man* (1909); and biographies. *The Autobiography of William Allen White* (posthumous, 1946; Pulitzer Prize, 1947), was completed by his son, the writer William Lindsay White (1900–73). **WHITE ANTS**, name often given to termites (q.v.).

WHITE BEAR LAKE, city of Minnesota, in the Ramsey and Washington counties, on White Bear Lake about 10 miles N.E. of Saint Paul. Primarily residential, the city has some manufacturing of small boats and is a popular fishing resort. It was incorporated in 1922. Pop. (1960) 12,849; (1970) 23,313.

WHITEFIELD, George (1714–70), British evangelist (q.v.) and organizer of the Calvinistic Methodists (see CALVINISM; METHODISM), born in Gloucester, England, and educated at Pembroke College, University of Oxford. During his undergraduate days Whitefield met John and Charles Wesley (see under WESLEY) and joined the Holy Club, the members of which were known as “methodists”. In 1736 Whitefield was ordained deacon (q.v.) in the Church of England (q.v.) and two years later followed the Wesley brothers to Savannah, Ga., as a missionary. Shortly thereafter Whitefield returned to England and was ordained a priest. Because of his unconventional manner of preaching and conducting services, many Church of England pulpits were closed to him; he therefore began to preach in the open air and attracted vast crowds by his eloquence. In 1739 he returned to Savannah, where he established an orphanage. During his stay in America he participated with the American Congregational clergyman Jonathan Edwards (q.v.) in inaugurating the revival movement that later became known as the Great Awakening; see REVIVALS, RELIGIOUS.

In 1741 Whitefield went to England to preach, extending his evangelical work to Scotland and Wales. Largely because of differences concerning the question of predestination (q.v.), Whitefield broke with John Wesley about 1741, although the two men maintained their

friendship. After this rupture Whitefield was recognized as leader of the Calvinistic Methodists.

Between 1744 and 1748 Whitefield again toured the American colonies, drawing enthusiastic crowds. On his return to England in 1748, he became chaplain (q.v.) to the British religious leader Selina Hastings, Countess of Huntington (1707–91), who aided him materially in his evangelical pursuits and enabled him to speak before members of the British nobility. After 1751 Whitefield devoted much of his time to preaching throughout Great Britain and Ireland and in America. Indefatigable in these efforts, he found time also to compile a hymnbook, which appeared in 1753. While in America, again on one of his preaching circuits, he died in 1770.

The extraordinary influence Whitefield exercised during his lifetime was due chiefly to his oratorical skill; he is said to have preached more than 18,000 sermons. His collected writings were published posthumously in seven volumes (1771–72).

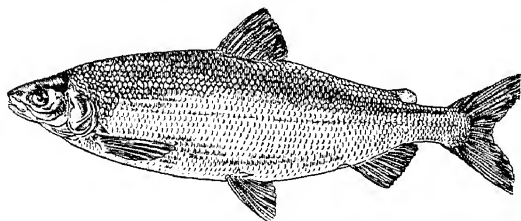
WHITEFISH, common name applied to various species of food fish belonging to the family Coregonidae, and native to lakes and streams of the Northern Hemisphere. The most familiar American species is the Great Lakes whitefish, *Coregonus clupeaformis*, found chiefly in the Great Lakes. It attains a maximum length of 2 ft., is olive green above and white below, has a small, toothless mouth, and feeds mainly on crustaceans. Whitefish inhabit deep waters throughout most of the year, but migrate to shoals to spawn in the fall. Highly prized for food, they are taken with nets and sold fresh or smoked. Whitefish were formerly abundant in the Great Lakes, but overfishing and depredation by lamprey (q.v.) have greatly reduced their number.

The Rocky Mountain whitefish, or mountain herring, *C. williamsoni*, another American species, is found in streams from the Rocky Mts. to the Pacific coast. It is a favorite of anglers, because it will take a fly. Another group of whitefish are the ciscoes, which include the lake herring, *C. artedii*, an important food fish of the Great Lakes; see HERRING.

WHITEFISH BAY, village of Wisconsin, in Milwaukee Co., on Lake Michigan, about 6 miles N. of central Milwaukee. The village was incorporated in 1892. Pop. (1960) 18,390; (1970) 17,394.

WHITEHALL, city of Ohio, in Franklin Co., on Big Walnut Creek, 7 miles E. of the center of Columbus, by which it is surrounded. The city is the site of the Columbus General Depot of the

Whitefish, *Coregonus clupeaformis*



United States Army. Incorporated as a village in 1947, Whitehall became a city in 1956. Pop. (1960) 20,818; (1970) 25,263.

WHITEHALL, borough of Pennsylvania, in Allegheny Co., a suburb about 7 miles s. of central Pittsburgh. Primarily residential, Whitehall has little manufacturing. Whitehall was incorporated as a city in 1948. Pop. (1960) 16,075; (1970) 16,551.

WHITEHEAD, Alfred North (1861–1947), British mathematician and philosopher, born in Ramsgate, England, and educated at Trinity College, University of Cambridge, where he taught mathematics from 1885 to 1911. Whitehead



Alfred North Whitehead

UPI

taught applied mathematics and mechanics at the University of London from 1911 to 1924 and was professor of philosophy at Harvard University from 1924 to 1936. He was professor emeritus at Harvard until his death and was also a fellow of the Royal Society and a member of the British Academy.

A brilliant mathematician who made lasting contributions in the field of theoretical mathematics, Whitehead also had a deep knowledge of philosophy and literature, and this background led him to the study of the foundations of mathematics, philosophy of science, and to the development of symbolic logic. He collaborated with his Cambridge pupil, the British mathematician and philosopher Bertrand Rus-

sell (q.v.), to write the three-volume *Principia Mathematica* (1910–13), which became one of the world's greatest works on logic and mathematics.

Opposed to the concepts of scientific materialism, Whitehead developed his "method of extensive abstraction" early in the 20th century by which he endeavored to explore and explain fundamental natural concepts in scientific terms and thereby to formulate a philosophy of natural science. To accomplish this, he examined concepts that, although acceptable to the pure scientist as unexplained hypotheses, had to be explained and verified through his method of philosophical analysis. This method was based upon the reality of the perception of objects and the relations between objects. He wrote two books on the philosophy of natural science, *An Enquiry Concerning the Principles of Natural Knowledge* (1919) and *The Concept of Nature* (1920).

In his later work Whitehead turned to more specific, heterogeneous philosophy, treating metaphysics, religion, and the principles of knowledge, and his concepts of knowledge created a revolution in epistemology (q.v.). His metaphysical system, the philosophy of organism, presented the notion of God not omnipotent but dependent upon the causality of the environment, and men who are dependent upon God for ideals and novelty, perceiving sense-data as pulses of feeling-quality. In this period he wrote *Science and the Modern World* (1925), *Religion in the Making* (1926), *Symbolism: Its Meaning and Effect* (1927), *Process and Reality: An Essay in Cosmology* (1929), *The Function of Reason* (1929), *Adventures of Ideas* (1933), and *Modes of Thought* (1938). Whitehead is generally recognized as one of the greatest of 20th-century philosophers. He also wrote *A Treatise on Universal Algebra* (1898), *The Principle of Relativity* (1922), and a valuable book on mathematics for the layman, *An Introduction to Mathematics* (1911).

See also **LOGIC: Modern Logic**; **MATHEMATICS**; **PHILOSOPHY: Modern Philosophy**.

WHITEHORSE, city and territorial capital of Yukon Territory, Canada, on the Yukon R. near the s. border. Whitehorse is the trading center of an extensive mining and trapping region. The city is a major stopover point on the Alaska Highway; it is connected by rail to Skagway, Alaska, and, in summer, by river steamer to Dawson. Founded during the Klondike gold rush as a service point for Dawson, Whitehorse declined until World War II, when it was the center for United States Army personnel con-

WHITE HOUSE

structing the Alaska Highway; in 1943, its population reached 40,000. Pop. (1976) 13,311.

WHITE HOUSE, official residence of the President of the United States, built in its original form in 1800, and situated at 1600 Pennsylvania Avenue in Washington, D.C. Known variously through its history as the President's Palace, the President's House, and the Executive Mansion, the building has always been most popularly known as the White House. It has been the home of every President in American history with the exception of the first, George Washington (q.v.), who approved the act that led to its construction. Although the White House has been subject to numerous renovations and additions in the 19th and 20th centuries, it has retained its classically simple character.

For a related discussion of the creation of the nation's capital, according to the plans of the French engineer and architect Pierre Charles L'Enfant (q.v.), see WASHINGTON, D.C.

Exterior. The site and the surrounding landscaped lawns and gardens of the White House occupy 18.07 acres, and include numerous trees of historical interest. Constructed of Virginia sandstone, the main building is a stately, white edifice, 170 by 85 ft., built in the classic style associated with the 16th-century Italian architect Andrea Palladio (q.v.). An Ionic portico (1829) on the north side faces Lafayette Square. On the south side is a semicircular portico (1824) with a private entrance on the ground floor for the President and his family.

Additions to the original building include the low-lying terraces or pavilions, which were constructed (1807) during the administrations of President Thomas Jefferson (q.v.), and reconstructed on those designs in 1902. The West Terrace, 165 by 35 ft., connects with the three-story Executive Wing (1902) containing the President's office, and the East Terrace, 215 by 35 ft. joins the three-story East Wing (1942). See LATROBE, BENJAMIN.

Interior. The private apartments of the President occupy the second floor of the main building, and the third floor consists chiefly of guest rooms and quarters for the staff. On the ground floor are cloakrooms, a china room, the kitchen, and the library.

On the first floor are the formal rooms of state, which are open to the public. Among these stately rooms are the East Room, the largest room in the White House, used for state receptions and balls, and where the bodies of Presidents William McKinley and John Fitzgerald Kennedy (qq.v.) once lay in state; the oval Blue Room, where the President receives guests

at state dinners; the Red Room, in which the First Lady, or President's wife, receives guests; the Green Room, used for informal receptions; and the State Dining Room, used for formal dinners.

History. Prior to the eventual establishment of the Federal government in Washington, President Washington lived in New York City and at Mount Vernon, Va. The White House then became the first public building erected in Washington. It was designed by the Irish-American architect James Hoban (q.v.), who won the \$500 public architectural contest. The cornerstone was laid on Oct. 13, 1792, and the building was essentially completed in 1800, when President John Adams (q.v.) and his family began to reside there in November.

During the War of 1812 (q.v.), British troops set fire to the structure on Aug. 4, 1814, destroying the interior. Hoban supervised its reconstruction, which was completed in 1817, and also added the south portico. White paint had been applied to the blackened exterior in 1817, and this encouraged the popularity of the name "White House". In 1902 this designation became official when President Theodore Roosevelt (q.v.) had the name engraved on his stationery.

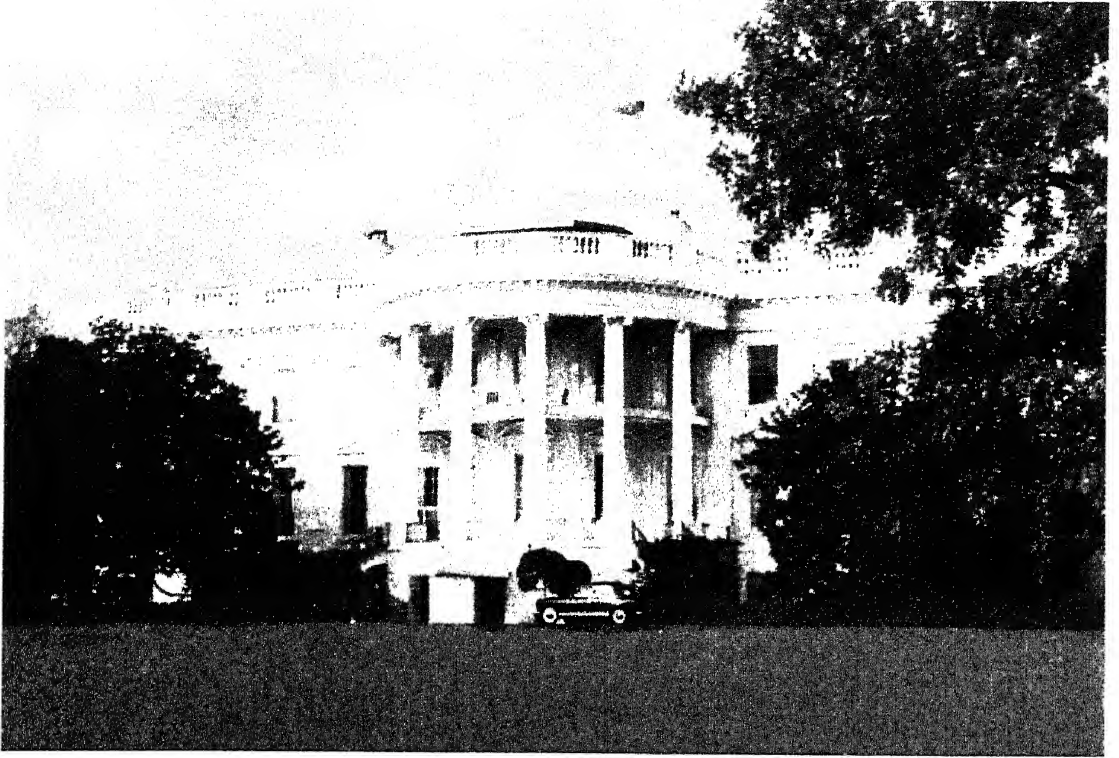
The White House was substantially renovated between 1948 and 1952, during the administration of President Harry S. Truman (q.v.), when new foundations and a steel framework were built to strengthen the original sandstone walls. As a result of the renovation, the number of rooms was increased from sixty-two to 132. Renovation costs totaled \$5,761,000.

A decade later, during the administration of President Kennedy, the interior of the White House was refurnished under the supervision of the President's wife, Jacqueline Bouvier Kennedy, later Mrs. Aristotle Onassis (1929–). A permanent art collection was assembled for the Executive Mansion, and President Lyndon Baines Johnson (q.v.) later issued (1964) an executive order establishing a Committee for the Preservation of the White House.

See full-color illustrations opposite and the following page.

WHITE LEAD, white pigment, which can be the hydroxycarbonate, hydroxysulfate, hydroxyphosphite, or hydroxysilicate of lead, and which is used extensively in the manufacture of white paint; see LEAD: *Compounds of Lead*; PAINTS. See also CHEMICAL COMPOUNDS, SYNTHETIC: *Paints and Coatings*.

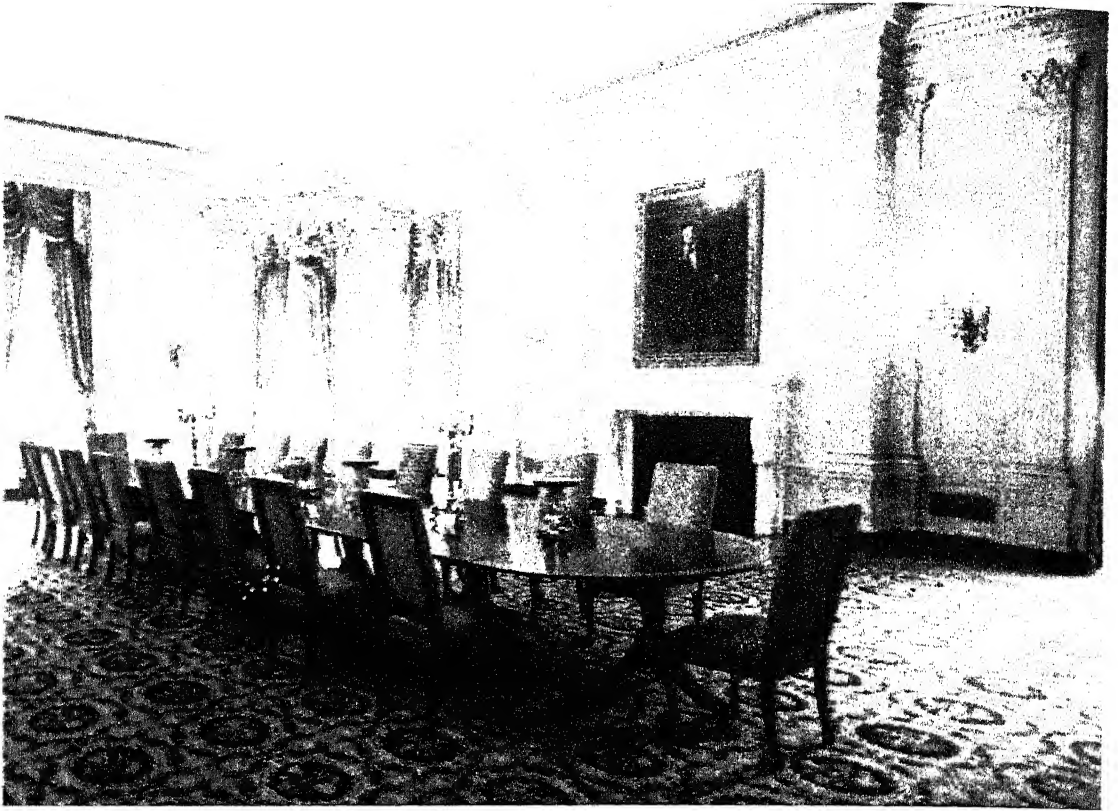
WHITEMAN, Paul (1891–1967), American band leader, born in Denver, Colo. At the age of



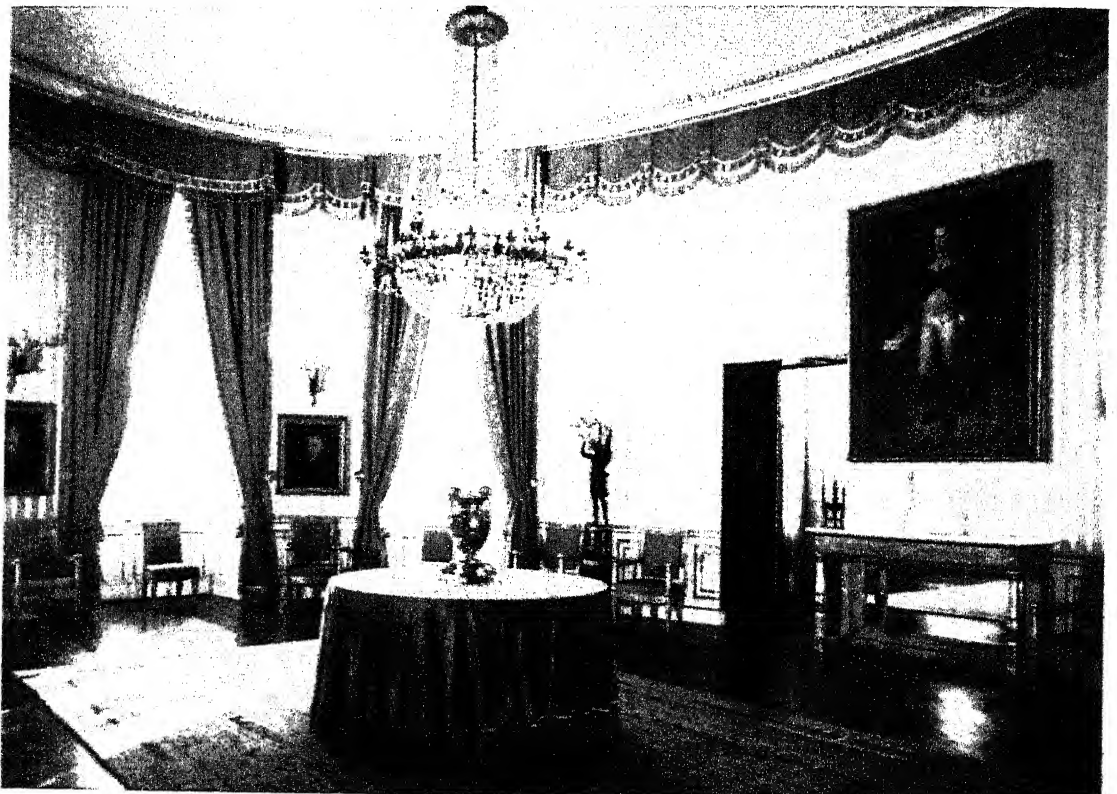
White House. Plate 1. Above: The Executive Mansion of the President of the United States is surrounded by an 18-acre park. Below: The Green Room, with its walls of watered silk and 19th-century furnishings, is used for informal and semiofficial gatherings.

Pictures Plates 1 and 2: Public Information Office of the White House





White House. Plate 2. Above: The State Dining Room, with a white-and-gold decor, features masterly carved oak paneling. It is used for formal entertainment and has a capacity of 140 persons. Below: The Blue Room, used for social, diplomatic, and official receptions, is lined with portraits of former Presidents.



WHITE MOUNTAINS

sixteen he joined the Denver Symphony Orchestra as a viola player. During World War I he conducted a military band. Whiteman organized his own band in 1919 and through it became the leading exponent of "symphonic jazz", a "sweet", mellow type of music played from written scores and hence differing markedly from "hot", improvised jazz. He introduced *Rhapsody in Blue* (1924) by the American composer George Gershwin (q.v.) and many other notable compositions in the sweet jazz idiom, and became known as the "King of Jazz". In 1943 he became musical director of a radio broadcasting company. Whiteman is the author of *Jazz* (1926) and *Records for the Millions* (1948). See *Jazz: Big-Band Jazz*.

WHITE MOUNTAINS, rugged range of peaks occupying the N.-central part of New Hampshire, and covering an area of about 1300 sq.mi. The range is part of the older or crystalline belt of the Appalachian system, rises from a plateau about 1600 ft. above sea level, and is divided by a defile known as the Crawford Notch, a lengthy gorge of the Saco R. West of Crawford Notch is

the principal subrange, the Franconia Mts. The highest point of the latter is Mt. Lafayette (5249 ft.) A notable feature of the Franconia range is the "Old Man of the Mountain", a natural stone profile of a human face near the top of Cannon, or Profile, Mt. (4007 ft.). The American novelist Nathaniel Hawthorne (q.v.) immortalized the "Old Man of the Mountain" in his story "The Great Stone Face".

To the E. of Crawford Notch is the Presidential Range, so called because many of the peaks are named for Presidents of the United States. The highest summit is Mt. Washington (6288 ft.), the highest in the State and a popular summer and winter resort. Other summits are Mt. Adams (5798 ft.), Mt. Jefferson (5715 ft.), Mt. Clay (5532 ft.), Mt. Monroe (5385 ft.), Mt. Madison (5363 ft.) and Mt. Eisenhower (4761 ft.). The White Mts. are noted for their scenic beauty; besides the peaks, there are numerous passes, streams, waterfalls, and pools. Along the lower slopes are luxuriant stands of coniferous trees. In 1925 the greater part of the range was made a national forest.

The Gale River, partially frozen, flows through the icy winter landscape of New Hampshire's White Mountains. In the background stands Mt. Lafayette, several miles east of Franconia Notch, a popular ski resort.



WHITE NILE

WHITE NILE. See NILE.

WHITE PLAINS, city in New York, and county seat of Westchester Co., on the Bronx R., 23 miles N.E. of the center of New York City. It is a residential suburb of New York City. Recently, it has developed into a center for executive offices of numerous national firms and has undertaken a major urban renewal project.

Educational institutions include Good Counsel College (1923), a Roman Catholic school for women; Westchester Community College (1946); and Westchester County Conservatory of Music. Among points of historic interest are the Elijah Miller House, which served for a time during the American Revolution (q.v.) as the headquarters of the American commander in chief George Washington (q.v.); the monument marking the spot on which the Declaration of Independence was first read in New York; and the site of the Battle of White Plains in 1776; see **WHITE PLAINS, BATTLE OF**. Nearby is Kensico Dam and Reservoir, part of the water supply system of New York City. Also notable is the Westchester County Center, with an auditorium seating 5000 persons.

White Plains is an important retail shopping center. Manufactures include food products, hearing devices, lenses, millwork, wood products, plastics, greeting cards, sheet metal, cut stone, structural and ornamental iron and steel products, automobile polish, and electronic medical equipment.

White Plains was founded by Puritans from Connecticut in 1683. It was made the county seat in 1759, incorporated as a village in 1866, and chartered as a city in 1916. On July 9, 1776, the Third Provincial Congress of New York met in White Plains, ratified the Declaration of Independence, and approved the first constitution of New York State. Pop. (1970) 50,220.

WHITE PLAINS, BATTLE OF, battle of the American Revolution (q.v.), fought on Oct. 28, 1776, near White Plains, N.Y. Involved in the action were a force of about 2000 Americans, under the command of General George Washington (q.v.) and about 13,000 British and Hessian troops led by the British commander in chief Sir William Howe (see *under* HOWE). Washington had lost New York City to the British late that summer, repulsed a British advance at Harlem Heights on Oct. 16, and withdrawn to White Plains on Oct. 21. The Americans hastily fortified Chatterton Hill, on the west bank of the Bronx R. near White Plains. On the morning of Oct. 28 Howe, employing about a third of his forces, launched strong frontal and flank attacks on Chatterton Hill, which had been reinforced

by additional American troops under General Alexander McDougall (1731?-86). Despite poor morale from defeats and desertions, the Americans offered unexpectedly strong resistance. The British captured the hill after severe fighting. Howe, having decided that the Americans were still too strong, decided to wait for reinforcements before pressing his advantage. Washington drew back to a well-fortified position 2 mi. north of White Plains. Because of Howe's hesitation in continuing the attack, Washington was able to withdraw unhurriedly across the Hudson R. to New Jersey. Howe lost an opportunity to destroy the American Continental army and thus to win the war in a single battle. American casualties totaled about 300, British, about 250.

WHITE RUSSIAN SOVIET SOCIALIST REPUBLIC, known also as **BELORUSSIA**, or **BYELORUSSIA**, constituent republic of the Soviet Union, in the w. part of the country, and bounded on the N.W. by the Lithuanian S.S.R. and the Latvian S.S.R., on the N. and E. by the Russian S.F.S.R., on the S.E. and S. by the Ukrainian S.S.R., and on the W. by Poland. For administrative purposes the republic is divided into six oblasts, namely Brest, Gomel, Grodno, Mogilev, Minsk, and Vitebsk. Area, 80,154 sq.mi.

THE LAND

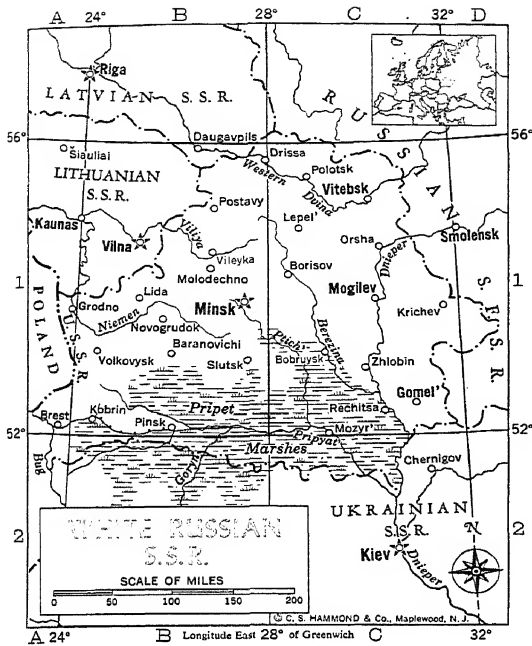
The outstanding topographic features of White Russia are a region of uplands, extending S.W. to N.E. across the republic, and a low plain that occupies most of the area to the S. and E. Elevations in the upland region are relatively low, seldom exceeding 1000 ft. In the southern portion of the plains region are vast tracts of densely forested and sparsely inhabited swampland known as the Pripyet Marshes. Forests, covering about 25 percent of the area of the republic, have valuable stands of elm, maple, oak, and white beech. White Russia contains nearly 4000 lakes and is traversed by numerous rivers, notably the Western Dvina in the N. and the Dnieper in the east-central section. Among the chief tributaries of the Dnieper in White Russia are the Pripyat', which traverses the swamp region, the Berezina, and the Sozh. The Bug R. delineates part of the S.W. boundary.

Climatic conditions are generally mild. Mid-winter temperatures average about 20° F., and the average midsummer temperature is about 64° F. Annual precipitation varies between 20 and 27 in.

THE PEOPLE

The population (census 1970) was 9,003,000. The capital is Minsk, other leading cities are Gomel, Vitebsk, and Mogilev (qq.v.).

WHITE RUSSIAN SOVIET SOCIALIST REPUBLIC



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Western Dvina (river)	C 1

White Russians, also called Belorussians, comprise about 80 percent of the population of the republic; Russians, Poles, Ukrainians, and Jews comprise most of the remainder. Most of the people belong to the Orthodox Church; a small minority is Roman Catholic. The language, Belorussian, is of the East Slavic group and is closely related to Russian.

Education is free and compulsory between the ages of seven and fifteen or sixteen. In the early 1970's some 2,000,000 pupils were attending primary, secondary, and special schools in White Russia. During the same period, some 137,000 students were enrolled in nearly 30 institutions of higher learning and about 144,000 students were attending some 125 technical col-

leges. The more noteworthy cultural centers are located in the city of Minsk and include an art museum, several historic museums, and botanical gardens.

THE ECONOMY

Almost completely destroyed during World War II, White Russia recovered rapidly in the post-war period. In recent years new power plants were constructed, and in the early 1970's about 18,777,000,000 kw hours were produced annually. The republic has an extensive system of highways and railways, and, through navigable rivers and the Dnieper-Bug canal system, White Russia has access to the Baltic and Black seas.

Industrial production plays an important role in the economy. Industry has increased tremendously since the end of World War II; by the mid-1950's output was three times the level of 1940. In the largest cities, which serve as the industrial centers of the republic, are plants producing building materials, foodstuffs, lumber products, machinery, steel, textiles, and wearing apparel. The production of trucks and tractors was introduced after 1945.

Agriculture is a leading occupation in the republic. In the late 1960's some 3000 state and collective farms were in operation, and more than 15,000,000 acres were under cultivation. In the swampland region about 3,000,000 acres have been drained, and about one third of this land is used for crops. The chief agricultural products include eggs, meat, milk, potatoes, sugar beets, and wool. The drained land yields abundant harvests of feed and grains, and also provides good pasture land for livestock raising.

The republic has large deposits of peat, which are used for fuel for industrial and power plants. Other natural resources presently being mined include chalk, clay, lime, and salt.

GOVERNMENT

The republic has its own constitution and government. The highest organ of state power is a unicameral supreme soviet, elected for a four-year term. The soviet elects a presidium and appoints the government of the republic, which comprises a council of ministers headed by a premier. The organs of state power within the oblasts are soviets of deputies representing the workers. Deputies are elected for terms of two years.

The franchise is enjoyed by all citizens of the U.S.S.R. who are eighteen years of age.

HISTORY

During the Middle Ages the territory that is now the White Russian S.S.R. was divided into a number of Slavic principalities. In 1240 invading Tatars (q.v.) destroyed most of the area which,

WHITE RUSSIAN SOVIET SOCIALIST REPUBLIC

was subsequently annexed by Lithuania. When, in 1569, Lithuania and Poland were completely merged, the White Russian territory came under Polish domination. With the partitioning of Poland in 1772, 1793, and 1795, Russia acquired present-day White Russia.

The territory served as a battleground between the 16th and 18th centuries as wars were waged between Poland and Russia. In the Napoleonic Wars (q.v.) following the invasion by the French in 1812, the land was laid waste by retreating Russians. The devastation of land in a primarily agricultural society led to extreme poverty and subsequent mass emigration by White Russians to Siberia and the United States during the 19th century.

A movement of national self-determination began to take shape at the end of the 19th century. In March, 1918, a White Russian democratic republic was proclaimed. The republic was crushed by the Bolsheviks (see BOLSHEVISM) and proclaimed a Soviet republic in January, 1919. Poland, however, determined to reestablish its historic boundaries, invaded the country. Under the terms of the Treaty of Riga, signed in 1921, Poland received the western part of White Russia. The remaining land became a constituent republic of the U.S.S.R. in 1922.

The Svisloch River flows through the center of Minsk, capital of the White Russian S.S.R. Gorki Park across the river is named after the famous Soviet writer Maksim Gorki.

Tass from Sovfoto

After the defeat of Poland by Germany in 1939, the Soviet Union annexed the formerly ceded White Russian area to the White Russian S.S.R., thereby nearly doubling the area of the republic. In June, 1941, during World War II, the Germans invaded White Russia, but were expelled in 1944. Except for certain small areas allocated to Poland, the political boundaries of the White Russian S.S.R., as of 1939, were confirmed by the terms of the treaty between Poland and the U.S.S.R. in 1945. In the same year the republic became an independent member of the United Nations.

WHITE SANDS NATIONAL MONUMENT, area of natural interest in New Mexico, in Otero and Doña Ana counties, about 15 miles s.w. of Alamogordo. The monument is administered by the National Park Service (q.v.).

WHITE SEA, arm of the Barents Sea, forming an indentation in the n.w. coast of the Soviet Union, and partly enclosed on the n. by Kola Peninsula. It is about 365 mi. long, has an area of about 36,700 sq.mi., an average depth of about 325 ft., and a maximum depth of 1115 ft. Major embayments include the Gulf of Mezen on the e., Dvina Bay on the s.e., Onega Bay on the s., and Kandalaksha Gulf on the n.w. At the entrance to Onega Bay are the Solovetskiye Islands. The White Sea receives the waters of numerous rivers, notably the Northern Dvina, the Onega, and the Mezen, and partly because of the resultant low salinity a large part of its surface is fro-



zen from November to May annually. The sea contains highly productive herring, cod, and seal fisheries. It is linked to the Baltic Sea by an inland waterway. Among the principal White Sea ports are Archangel, Kem, Belomorsk, Onega, Mezen, and Kandalaksha.

WHITE SETTLEMENT, town of Texas, in Tarrant Co., a suburb about 14 miles w. of Fort Worth. Primarily residential, the town has little manufacturing. The town was originally known as Liberator, or Liberator Village. Pop. (1960) 11,513; (1970) 13,449.

WHITE SNAKEROOT, common name of a perennial herb, *Eupatorium rugosum*, of the Compositae family. The plant poisons animals, and milk from poisoned cows poisons man. In the past, the disease produced by poisoned milk (milk sickness) killed hundreds of persons and nearly wiped out whole villages. Occasional cases of milk sickness still occur.

White snakeroot is common in open woods or hedgerows, especially in damp, rich soils throughout the central and eastern United States and adjacent Canada. It often becomes luxuriant after trees are cut down, but does not persist more than a few years completely in the open. Plants of white snakeroot are not distinctive. They bear erect, stiff, branched or unbranched stems 3 to 4 ft. tall with simple, large, thin, opposite leaves. Each leaf is distinctly veined, with the three major veins protruding from the undersurface of the leaf; the upper surface is nearly smooth. Open clusters of tiny white flowering heads appear at the tips of branches in summer or fall, giving the plants a lacy appearance.

The poisonous principle, a complex, 16-carbon carbohydrate, is concentrated in the foliage of white snakeroot. When animals eat the foliage, this carbohydrate apparently interferes with the proper utilization of starches and sugars in the diet. The resulting disease, called trembles in animals, develops slowly. It is characterized by sluggishness, weakness, trembling

or shaking, and inability to stand, normally followed by coma and death. The poisonous principle of white snakeroot is carried in the milk of lactating animals. If such milk is consumed by humans, it produces a disease characterized by lassitude, severe abdominal pain, and severe repeated vomiting. As the disease progresses, an unusual odor (of acetone) develops on the breath, and in the past, experienced physicians were often able to diagnose a case of milk sickness on entering a house. Before the cause of this disease was understood, many people never recovered fully or died. Poisoning from white snakeroot is presently rare because milk from ill animals is regularly discarded, and milk from wide areas is pooled (with resulting dilution) before reaching the consumer.

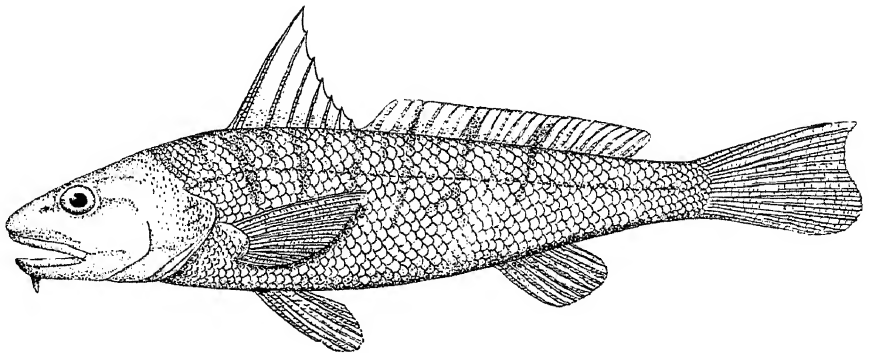
J.M.K.

WHITE SULPHUR SPRINGS, city of West Virginia, in Greenbrier Co., in the Allegheny Mts., 10 miles E. of Lewisburg. The city has been a well-known health resort since its mineral springs, with their curative value, were discovered in the 1830's. Among the points of interest are the "President's Cottage", which served as the summer home of Presidents Martin Van Buren, John Tyler, and Millard Fillmore (qq.v.), and the Greenbrier Hotel, famous as the "Old White" during the Civil War, when it was used as a military hospital. In the vicinity of the city are Greenbrier State Forest and Blue Bend Recreation Area. White Sulphur Springs was settled about 1750 and incorporated in 1909. Pop. (1960) 2676; (1970) 2396.

WHITEWASH, white solution, consisting principally of unslaked lime, glue, and water, and used as an inexpensive coating for walls and ceilings; see LIME.

WHITWOOD. See TULIP TREE.

WHITING, common name for any of several marine, acanthopterygian food fishes, so called because of the whiteness of their flesh or underparts. The common whiting, *Menticirrhus americanus*, belongs to the Creaker family, Sciaenidae, and is found along the Atlantic



Kingfish, *Menticirrhus saxatilis*, is the largest member of the whiting family.

coast from Brazil to Chesapeake Bay. The long, slender body bears two spiny dorsal fins and has an overall silver-gray color; it reaches a length of 12 in. and weighs approximately 2 lb. In May the fish approach the coast to spawn, later returning to deep water and strong currents. They feed on crabs, shrimps, and other crustaceans. *M. littoralis*, the surf whiting, is similar in structure to the common whiting, and spends its entire life near the shore. The name whiting is applied also to several varieties of hake (q.v.), including the kingfish.

WHITMAN, Marcus (1802–47), American pioneer and missionary, born in Rushville, N.Y., and educated as a physician. In 1834 he was assigned to work as a medical missionary among the Cayuse (q.v.) Indians of the Oregon country by the Methodist American Board Mission, which he helped found. He made an exploratory visit to the region in 1835 and went to settle there with his wife, Narcissa Prentiss Whitman (d. 1847), and several other missionaries the next year. Whitman and his party were the first to travel by wagon as far as Oregon country, where they established a mission near present-day Walla Walla, Wash. To prevent one of the missions near him from being closed, Whitman made a trip to the Methodist mission headquarters in Boston in 1842–43, traveling 3000 mi. on horseback. Along the way he urged Americans to settle in the Oregon country, and when he returned in 1843 he accompanied a large group of settlers along the Oregon Trail (q.v.). Whitman gained fame for his hazardous winter journey, and a legend arose twenty years after his death that he had made it in order to persuade the Federal government not to allow the Hudson's Bay Company (q.v.) to acquire the Oregon region for the British. The truth of the legend was hotly debated for a time, but today scholars generally discredit it. When, in 1847, an epidemic of measles was brought under control for white children but proved fatal to Indian children, hostile Cayuse sacked the mission and killed Whitman, his wife, and twelve associates. The mission grounds, which contain the graves of Whitman and his wife, are preserved as a national historic site by the National Park Service (q.v.).

WHITMAN, Walt(er) (1819–92), American poet, born in South Huntington, Long Island, N.Y. He attended briefly the public schools of Brooklyn. From the age of twelve Whitman worked successively as office boy, compositor, itinerant schoolteacher, carpenter, and journalist. He served as editor of the newspaper the Brooklyn (N.Y.) *Eagle* from 1846 to 1848 but was

discharged because of his radical advocacy of the Free-Soil Party (q.v.). In the spring of 1848 he joined the staff of the New Orleans (La.) *Crescent* for a short period and then returned to Brooklyn, where for the next six years he practiced journalism sporadically and also worked for his father, Walter Whitman (1789–1855), as a carpenter.

Early Works. In 1855 Whitman paid for and published a 94-page volume of twelve poems entitled *Leaves of Grass*. The book went without much notice, except for Whitman's own anonymous, laudatory reviews. Neither critics nor public were prepared for his radical innovations in style nor for his startling frankness in the treatment of sexual themes. Among the few readers to appreciate the qualities of genius in this original, unconventional book were the American writers Ralph Waldo Emerson and Henry David Thoreau (qq.v.). A second, much larger edition of *Leaves of Grass* appeared in 1856, and Whitman periodically revised and enlarged the book throughout the rest of his life, issuing the tenth, or "deathbed", edition in 1891. A number of separately published volumes ultimately were incorporated into *Leaves of Grass*, notably *Passage to India*, *November Boughs*, and *Good-bye, My Fancy*.

The Civil War. In 1862, during the American Civil War, Whitman went to the battlefield in search of his brother George Whitman (b. 1829?), an officer in the Union army, who had been wounded at Fredericksburg. Whitman remained in Washington and Virginia throughout the war years, serving as a volunteer nurse in army hospitals and supporting himself by clerical and journalistic jobs. In 1865 he became a clerk in the Indian Bureau of the Department of the Interior, but was fired by the secretary of the department on the grounds that *Leaves of Grass* was an indecent book. With the help of influential friends, Whitman obtained a clerkship in the office of the attorney general, a position he held until a paralytic stroke in January, 1873, forced his retirement from government service. During his years in Washington he published a group of war poems, *Drum-Taps* (1865); and *Sequel* (1866), which includes his elegies for President Abraham Lincoln (q.v.). "When Lilacs Last in the Dooryard Bloom'd" generally considered his finest poem, and "O Captain! My Captain!", his best-known work. This period also saw the publication of his most important prose work, *Democratic Vistas* (1871), a long, candid essay acknowledging the problems and evils rife in American democracy but confidently expressing hope in its great future.



Walt Whitman

Later Years. From 1873 until his death Whitman lived in Camden, N.J. Surrounded by a devoted circle of friends, he lived in a state of semi-invalidism, continually revising *Leaves of Grass* and issuing new poems and prose. He gathered nature jottings and war vignettes into *Specimen Days and Collect* (1882), a book of simple but moving prose. In his last years Whitman's Camden home, now a museum, became a national literary shrine to which visitors from many countries made pilgrimage. The poet was buried in Camden in a tomb he had designed.

Critical Evaluation. Whitman has come to be regarded as among the great American poets. His reputation abroad is perhaps even greater than at home. Because of his fearless championing of the dignity of the common man, of the freedom of the individual, and of the ideal of universal brotherhood, he has been hailed as the foremost poetic spokesman of the American way of life; and his works have been translated into many languages. His poetic style parallels his feeling for personal liberty. Although untrammelled by the conventional rules of prosody, his verse is marked by a strict organic progression, in which each part maintains its proportion to the whole. He originated a dis-

tinctive form of free verse that distinguishes his work from that of other poets and gives it a highly personal quality. Characteristic features of his poetry, besides the sparing use of rhyme and meter, are repetition, parallel structure, and rhetorical declamation. These features are apparent in such outstanding individual poems as "Song of Myself", "Out of the Cradle Endlessly Rocking", "Crossing Brooklyn Ferry", and "Pioneers! O Pioneers!".

Whitman's influence on contemporary American literature is incalculable. It can be traced in the works of such diverse poets as Carl Sandburg, Amy Lowell, Archibald MacLeish, T. S. Eliot (qq.v.), and Allen Ginsberg (1926-). Whitman was a trail blazer and liberator in his thought as well as his style. He sounded a note of vigorous affirmation of life at a time when such leading American writers as Edgar Allan Poe, Herman Melville, and Nathaniel Hawthorne (qq.v.) were obsessed with problems of evil and death. Although Whitman was unsparing in his criticism of the crass materialism and political corruption of his period, he kept his democratic faith and communicated that faith, in all its intensity, to succeeding generations. Additional knowledge of the poet is revealed in his correspondence, published in five volumes (1961-69).

C.B.Wi.

WHITMAN MISSION NATIONAL HISTORIC SITE. See WHITMAN, MARCUS.

WHITNEY, Eli (1765-1825), American inventor, best known for his invention of the cotton gin (q.v.), born in Westboro, Mass., and educated at Yale College (now Yale University). In 1792 he was a guest on the plantation, near Savannah, Ga., of Catharine Greene (d. 1814), widow of the American Revolutionary War general Nathanael Greene (q.v.). There, he designed and built a model for a machine that would separate the seeds from the fibers of the short-staple cotton plant, work that until that time had been done by hand. His first cotton gin was produced in 1793. With the gin, cotton could be cleaned so quickly that it became the most important crop in the South and the basis of a profitable agricultural economy. See also SLAVERY: *Modern Period*.

Whitney entered into partnership with the plantation manager, Phineas Miller (d. 1803), who married Mrs. Greene in 1796, to manufacture cotton gins at New Haven, Conn. A disastrous factory fire prevented the partners from making enough gins to meet the demand, and manufacturers throughout the South began to copy the invention. Although Whitney and Miller received a patent on the gin in 1794, it was



Eli Whitney

Bettmann Archive

not until 1807 that a decision was rendered protecting their patent; and in 1812 Congress denied Whitney's petition for renewal of this protection. In all, he profited very little from it.

In 1798 Whitney turned to the manufacture of firearms. After signing a contract to supply the Federal government with 10,000 military muskets, he built a factory near New Haven, at present-day Hamden, in which he successfully originated the mass production system of manufacturing standardized, interchangeable parts.

Whitney was one of the original twenty-nine Americans chosen for the Hall of Fame for Great Americans (q.v.) in 1900.

WHITNEY, William Dwight (1827–94), American philologist and Sanskrit scholar, born in Northampton, Mass., and educated at Williams College, and at Yale College (now Yale University), and at the universities of Berlin and Tübingen. In 1854 he was appointed professor of Sanskrit and in 1869 professor of comparative philology at Yale, posts he held until his death. He was a founder and first president (1869) of the American Philological Association, president (1884–90) of the American Oriental Society, and editor in chief of *The Century Dictionary* (6 vol., 1889–91); see **DICTIONARY**. A pioneer in the study of Sanskrit philology, Whitney also profoundly influenced the development of linguistic science and contributed to the study of modern languages and lexicography. Among his

more than 300 works are *The Life and Growth of Language* (1875) and *Sanskrit Grammar* (1879). See **LANGUAGE: The Study of Language**; **PHILOLOGY**; **SANSKRIT LANGUAGE**.

WHITNEY, MOUNT, peak of the Sierra Nevada, in E. California. It is the highest mountain in the United States, exclusive of Alaska, having an altitude of 14,494 ft. above sea level. Its slope is precipitous on the E., rising abruptly for about 11,000 ft. from Owens Valley. The mountain was named in honor of Josiah Dwight Whitney (1819–1896), American geologist and chief of the expedition that discovered it in 1864.

WHITSUNDAY. See **PENTECOST**.

WHITTIER, city of California, in Los Angeles Co., 12 miles S.E. of the city of Los Angeles. It lies in an area producing petroleum, citrus fruits, avocados, and walnuts. Whittier is primarily a residential city; it is also a packing and shipping point for agricultural products, and has some foundries and oil well supplies. The city is the seat of Whittier College (1901), where President Richard Milhous Nixon (q.v.) was educated, and the largest Quaker church in the world. Whittier was founded by members of the Society of Friends in 1887 and named in honor of the American poet John Greenleaf Whittier (q.v.). It was incorporated as a city in 1898. Pop. (1960) 33,663; (1970) 72,863.

WHITTIER, John Greenleaf (1807–92), American poet, born near Haverhill, Mass., and largely self-educated. The young poet's earliest work attracted the attention of the American abolitionist William Lloyd Garrison (q.v.), and in 1826 Garrison asked him to contribute to the *Free Press*, a newspaper in Newburyport, Mass., for which Garrison was editor. Thus Whittier began a long career as contributing editor, essayist, and poet. Always deeply concerned with politics and social welfare, he served in the Massachusetts legislature in 1834–35, was a founder of the Liberty Party (q.v.) in 1839, and participated in the founding of the Republican Party (q.v.) in 1854. For more than thirty years, Whittier devoted most of his energy to trying to achieve the abolition of slavery in the United States; see **ABOLITIONISTS**.

Whittier's earliest works, including his first published work, *Legends of New England in Prose and Verse* (1831), were pastoral evocations of the rugged farm life of New England. With the end of the American Civil War, Whittier returned to his pastoral themes. Often considered his masterpiece and certainly his most popular work is the narrative poem *Snow-Bound, A Winter Idyll* (1866). Based on the poet's childhood memories, this work illustrates

his sincere, moralistic, yet emotional style. Short, colorful, and well-loved poems by Whittier, memorized by generations of American schoolchildren in the late 19th and early 20th centuries, include "The Barefoot Boy" (1856) and "Barbara Frietchie" (1864).

A deeply religious man, Whittier followed the Quaker faith of his parents and is often called "the Quaker poet"; see FRIENDS, SOCIETY OF. Many hymns written by Whittier have been adopted by various Protestant faiths; among these are "O sometimes gleams upon our sight" (1852), "Immortal Love, forever full" (1856), and "Dear Lord and Father of mankind" (1872).

WHITTINGTON, Richard, or WHITTINGTON, DICK (1358?-1423), English merchant, lord mayor of London, born probably in Gloucestershire. Nothing is known of his early life, except that he was the son of a knight. Whittington eventually became a mercer in London and in 1393 he was an alderman. In 1397, and again in 1406 and 1419, he was elected lord mayor of London. He advanced large sums of money to the English kings Henry IV and Henry V (qq.v.). At his death he left the bulk of his property to charity, including funds for the rebuilding of Newgate Prison and for the establishment of Whittington College, which existed for a hundred years before its suppression in 1548.

According to legend the lad Whittington went to London and found employment as a scullion. To the freight of an outgoing vessel he contributed his cat, which was sold for a large sum in rat-infested Barbary. Meanwhile, the boy, wearying of abusive treatment, started to leave the city, but hearing the bells of Saint Mary-le-Bow Church, which seemed to say,

"Turn again, Whittington,
Lord Mayor of London,"

he went back to his work, received the proceeds from the sale of his cat, married, and, living happily, rose to the prophesied post. Similar stories are found in the folklore of several countries.

WHITTLE, Sir Frank (1907-), British aeronautical engineer and aviator, born in Coventry, England, and educated at Leamington College and the University of Cambridge. He became an apprentice in the Royal Air Force in 1923, and three years later entered the Royal Air Force College in Cranwell as a flight cadet. He retired from the R.A.F. in 1948 with the rank of air commodore.

While attending the R.A.F. College, Whittle became interested in jet propulsion (q.v.) for aircraft, and by 1930 he had developed the concept of a turbojet engine and filed his first patent. In 1936 he organized a privately financed company, Power Jets, Ltd., for the development of his engine.

The first flight powered by his engine took place in May, 1941, during World War II, in a British experimental fighter plane. Toward the end of the war turbojet fighters were engaged in military operations over Great Britain against German guided missiles. The Whittle engine is the prototype of turbojets currently used in British and American aircraft.

Knighted in 1948, Whittle received many other honors, including the United States Legion of Merit in 1946, the Churchill Gold Medal of the Society of Engineers in 1952, and the Christopher Columbus Prize of the city of Genoa in 1966.

WHOOPING COUGH, common name applied to an acute, infectious disease of the respiratory tract, caused by the bacillus *Hemophilus pertussis*. The disease, known medically as pertussis, is characterized in its late stages by a deep cough ending in a peculiar high-pitched whooping sound. Infection is transmitted by direct contact, usually by means of droplets sprayed into the air during coughing spells. Whooping cough is worldwide in distribution and occurs periodically in epidemics. Most cases occur in children under five years of age. The severity of the attack varies, with children less than one year old being the most seriously affected. Among infants whooping cough results in more deaths than all other infectious diseases combined. The disease is rarely fatal in children over five.

The incubation period of whooping cough ranges from seven to fourteen days. The disease begins with a running nose, a harsh cough, and a slight fever. These symptoms, which characterize the catarrhal stage, last for one or two weeks, during which period the disease is highly infectious. The stage that follows is marked by the development of the characteristic whoop. The coughing spells occur most frequently at night and usually continue until vomiting ensues. Nosebleeds often result from the severity of the cough. The heavy coughing may persist for as long as four weeks, occasionally even longer. Complications include pneumonia (q.v.) caused by *H. pertussis* or other bacteria. Small areas of lung collapse occur almost invariably and hemorrhages of the eye can also occur. Involvement of the central nervous system (see NERVOUS SYSTEM) with hemorrhage is not rare, and can cause permanent brain damage or death.



*The whooping crane, *Grus americana*, largest of the North American cranes, is one of the rarest birds in the world. Its loud call can be heard at a considerable distance.*

Russ Kinne—Photo Researchers

No specific cure is known for whooping cough. Present-day treatment consists chiefly of rest in bed, attempts to control the coughing spells by means of sedatives (q.v.), and replacement of fluid lost from vomiting. Antibiotics (see ANTIBIOTIC) are administered to treat complications such as pneumonia.

Preventive measures are important in the control of whooping cough. Antipertussis vaccine provides immunity against the disease for a period varying from five months to two years; see IMMUNITY. Although of short duration, the conferred immunity may last long enough to carry children through the years when infection is most dangerous. In the United States the vaccine is administered by most local boards of health, generally to children from the ages of six months to twelve months.

WHOOING CRANE, name applied to the largest North American crane (q.v.), *Grus americana*. The bird has a resounding whooplike call and is white with black wing tips. It is over 4 ft. in length and has an average wingspread of 7 ft. The whooping crane ranges from northern Alberta to the coast of the Gulf of Mexico. Formerly a flourishing species, it is presently close to extinction. The bird is afforded Federal protection in the Aransas National Wildlife Refuge in Texas, and its annual migrations are at-

tended by official appeals to the public not to molest the few survivors. The world population of whooping cranes totaled fifteen at the lowest point in 1941. In 1970 they numbered about fifty.

WHORTLEBERRY. See HUCKLEBERRY.

WHYDAH BIRD. See WEAVERBIRD.

WHYMPER, Edward (1840–1911), British mountain climber, writer, and illustrator, born in London. His interest in climbing began when he was commissioned in 1860 by a British publisher to sketch scenes in the French Alps. In 1861 he scaled Mont Pelvoux (12,970 ft.) and in 1864 Pointe Les Écrins (13,462 ft.), second highest and highest peaks, respectively, in the French Dauphiné Alps. In 1865, after six unsuccessful attempts to climb the southwestern face of the Matterhorn (q.v.) in Switzerland, he attempted the climb on the eastern face, which then was considered impossible. He and his party succeeded and were the first ever to complete the ascent of the Matterhorn. In 1880 he became the first climber to reach the summit of Chimborazo (20,561 ft.), the highest peak in Ecuador of the Cordillera Real range of the Andes. Accounts of his expeditions are contained in *Scrambles Amongst the Alps in the Years 1860–69* (1871, illustrated by himself) and *Travels Amongst the Great Andes of the Equator* (1892). His findings and observations contributed greatly to arctic exploration, the study of mountain sickness, and the improvement of the aneroid barometer (see BAROMETER). See also MOUNTAIN CLIMBING.

WICHITA, city in Kansas, and county seat of Sedgwick Co., at the confluence of the Arkansas and Little Arkansas rivers, 200 miles s.w. of Kansas City. Wichita is the commercial, financial, and manufacturing center of northern Oklahoma and southern Kansas, a region rich in oil, gas, wheat and other grains, livestock, dairy products, and poultry. The city is the largest market in the world for broomcorn and a leading market and shipping point for livestock. Wichita is the largest city in the State in population. The city park system includes a number of recreational areas, among them municipal golf courses and a zoo. Educational institutions include Wichita State University, established in 1926 but embracing institutions that date back to 1892, Friends University (1898; Society of Friends), and Sacred Heart College (1933; Roman Catholic). Among cultural facilities are the Wichita Art Association; museums of art, science, and local history; a public library; and a municipal auditorium.

Commerce and Industry. Industrial establishments in the city include grain elevators, stockyards, meat-packing plants, oil refineries, flour mills, and railroad shops. The outstanding manufacture is airplanes; others include oil-field and agricultural machinery, oil-refinery equipment, automotive parts, heating equipment, machine tools, dies, building materials, leather goods, textiles, and printed matter. Wichita is governed under the council-manager system.

History. Wichita was settled in 1864 as a trading post near a village of the Wichita Indians. Later it was a terminal point for drovers on the Chisholm Trail, an early overland cattle route. The site was plotted in 1869. Wichita was incorporated as a town in 1870 and chartered as a city in 1886.

Population. Between 1910 and 1950 the population of Wichita increased from 52,450 to 168,279. In 1960 the population was 254,698 and in 1970 it was 276,554.

WICHITA FALLS, city in Texas, and county seat of Wichita Co., on the Wichita R., about 105 miles n.w. of Fort Worth. It is a cultural, industrial trade, and distribution center for a vast oil, wheat, and cattle region. Some of the most productive oil fields of the Southwest are in the vicinity, and the city is headquarters for many oil companies and for numerous jobbers and wholesalers of oil-mining equipment. Industries include oil refining, food processing, and the manufacture of oil-field and electronics equipment.

Midwestern University, established in 1951 by the merger of various colleges, is located in the

city. In the vicinity is Sheppard Air Force Base. Neighboring lakes Wichita, Arrowhead, Kickapoo, and Possum Kingdom provide opportunities for boating, hunting, camping, and fishing.

History. Wichita Falls was settled in the 1870's. It developed as a cattle town after the completion of a railroad line, in 1882, became county seat in 1883, and was incorporated as a city in 1889. The city grew rapidly in size and importance after World War I, mainly as a result of the opening of rich oil fields and the building of extensive irrigation projects in the region. Pop. (1960) 101,724; (1970) 97,564.

WICKERSHAM, George Woodward (1858–1936). American lawyer and public official, born in Pittsburgh, Pa., and educated at Lehigh University and the University of Pennsylvania. He was attorney general in the cabinet of President William Howard Taft (q.v.) from 1909 to 1913. From 1923 until his death he was president of the American Law Institute, and from 1924 to 1929, a member of the commission on progressive codification of international law (q.v.), appointed by the Council of the League of Nations. In 1929 President Herbert Clark Hoover (q.v.) appointed Wickersham chairman of the National Law Enforcement Commission, which became known as the Wickersham Commission and was most famous for its negative report, released in 1930, on the status of prohibition (q.v.).

WICKLIFFE, city of Ohio, in Lake Co., about 14 miles n.e. of Cleveland, near Lake Erie. The varied manufactures include machinery and petroleum products. It is the site of Borromeo Seminary of Ohio, established in 1954. The city of Wickliffe was incorporated in 1916. Pop. (1960) 15,760; (1970) 21,354.

WICKLOW, county of the Republic of Ireland, in Leinster Province, bounded on the n. by County Dublin, on the e. by the Irish Sea, on the s. by County Wexford, and on the w. by County Carlow and County Kildare. The dominant feature of the terrain is the Wicklow Mts. and their foothills; the highest summit is Lugnaquilla (3041 ft.). There are many deep glens noted for their beauty. The Liffey and Slaney rivers rise within the county. Dairying and cattle and sheep raising are the most important industries; oats, potatoes, cattle feed, and market crops are grown in the fertile lowlands. Granite and slate are quarried, and lead, copper, iron, and pyrites are mined. The county has interesting ruins, which with its fine scenery attract many tourists. Bray is a seaside resort. Wicklow is the administrative center of the county. Area, 782 sq.mi.; pop. (1971) 66,295.

WIDENER LIBRARY. See HARVARD UNIVERSITY.
WIDGEON, common name for freshwater ducks of the genus *Mareca*. They are distinguished by short bills; small legs and feet; long, pointed wings, and a large white patch on the forewing. The common, or Old World widgeon, *M. penelope*, is approximately 18 in. in length; its crown is golden-yellow; head and neck, chestnut flecked with green, and body, vermiculated gray above and white below. It breeds in northern and subarctic swamps, and winters in the lakes, rivers, and coastal waters of the North Temperate Zone. The American widgeon or baldpate (q.v.), *M. americana*, is slightly larger, and is similar in color, except that the crown is white and the head grayish with a dark green stripe running from the eye to the nape. It breeds in northwestern United States, Canada, and Alaska, and winters from southern Canada to South America. The Chiloé widgeon, *M. sibilatrix*, resembles the other widgeons, except that the head is metallic green and the face white. This bird is common in southern South America. The widgeon is prized as a game bird by sportsmen.

WIDOR, Charles Marie (1845–1937), French organist and composer, born in Lyon. In 1870 he became organist at Saint Sulpice in Paris, a post he retained until his retirement in 1933. He was appointed professor of organ at the Paris Conservatory in 1890 and from 1896 was also professor of composition. He collaborated with his pupil, the French Protestant clergyman and organist Albert Schweitzer (q.v.), on an edition of the organ works of the German composer Johann Sebastian Bach (see *under* BACH). Widor was an ambitious and prolific composer of much skill but little originality. Organists, however, revere his organ works as vehicles of the instrument, particularly the ten symphonies, or suites, which exploit the resources of the organ to the full and bring forth its grandest effects.

WIDOW BIRD. See WEAVERBIRD.

WIELAND, Christoph Martin (1733–1813), German writer, born in Oberholzheim, Württemberg, and educated at the University of Tübingen. His early works consist mainly of fervently religious poetry. In 1760 he abandoned his intense piety and became an outspoken freethinker. He then wrote a play, *Lady Johanna Gray* (1758), the first German drama in blank verse, and ridiculed his early faith in the romance *Abenteuer des Don Sylvio von Rosalva* ("Adventure of Don Sylvio of Rosalva", 1764). Between 1762 and 1766 Wieland translated twenty-two plays by the English playwright William Shakespeare (q.v.). These translations made

Shakespeare widely known in Germany. His novel *Geschichte des Agathon* (1766–67; Eng. trans., *The History of Agathon*, 1773), an account of a young man's education, is a forerunner of the modern psychological novel.

In 1769 Wieland became professor of philosophy at the University of Erfurt. His outstanding work while at Erfurt was *Der Goldene Spiegel* ("The Golden Mirror", 1772), a cycle of tales about an enlightened ruler. Following publication of the book, he went to Weimar as tutor to Charles Augustus (1757–1828, son of the regent of Saxe-Weimar-Eisenach Anna Amalia (1739–1807). He founded and edited *Der Teutsche Merkur* ("The German Mercury", 1773–1810), which became a leading literary journal, and *Das Attische Museum* ("The Attic Museum", 1796–1809), in which he published his translations of Greek and Latin classics. Among the works of this period are *Die Abderiten* (1774; Eng. trans., *The Republic of Fools*, 1861), a satire of provincial life; and *Oberon* (1780; Eng. trans., 1798), a witty and sophisticated verse romance, generally considered his masterpiece.

See GERMAN LITERATURE: *The Classical and Romantic Period*.

WIELAND, Heinrich (1877–1957), German chemist, born in Pforzheim, and educated at the universities of Munich and Berlin. He taught chemistry at the University of Munich from 1904 to 1913 and from 1913 to 1917 served as professor of organic chemistry at that university. He was again professor and director of the chemical laboratories at the university from 1925 to 1952, and was made a fellow of the Royal Society in 1931.

Wieland's principal field of research was bile (q.v.) acids, nitrogen compounds, toxic biological substances, morphine (q.v.), and anesthetics; see ANESTHESIA. He also discovered the structure of cholesterol (q.v.), and for his discoveries concerning the nature of the substance that gives color to bile, Wieland was awarded the 1927 Nobel Prize in chemistry.

WIEN, Wilhelm (1864–1928), German physicist, born in Gaffken, and educated at the universities of Göttingen, Heidelberg, and Berlin. In 1890 he became an assistant to the physicist Hermann Ludwig von Helmholtz (q.v.) at the Imperial Physical Technical Institute at Charlottenburg, and in 1892 he also became Privatdocent at the University of Berlin. From 1896 to 1899 he taught at the technical high school of Aachen, and in the following year he became professor of physics at the University of Gießen. From 1900 to 1920 he was professor of physics at the University of Würzburg, and in 1913

he visited the United States to lecture at Columbia University. From 1920 to 1928 he was professor of physics at the University of Munich.

Wien is noted for his work on black-body radiation; see *HEAT: Transfer of Heat*. He developed a formula for determining the energy density associated with particular wavelengths for any given temperature of the radiating body. He also discovered a law, known as Wien's displacement law, which states that the product of the wavelength of maximum energy emission and the temperature is a constant. His contributions in the field of radiation laid the foundation for the development of the quantum theory (q.v.). Wien conducted important research in other fields, including optics and X rays. For his discovery of laws regarding heat radiation he was awarded the 1911 Nobel Prize in physics.

WIENER, Alexander Solomon (1907–76), American physician and clinical pathologist, born in Brooklyn, N.Y., and educated at Cornell University and the Long Island College of Medicine. He founded and became director of the Wiener Laboratories in 1935 and of the Wiener Serum Laboratory in 1943. After 1938 he taught forensic medicine at the postgraduate medical school of New York University and served as official serologist of New York City.

Noted for his outstanding work in hematology (see *BLOOD*), Wiener was co-discoverer with the Austrian-American pathologist Karl Landsteiner (q.v.) of the Rh factor (q.v.) in blood, of great importance as the cause of many infant deaths and as a condition affecting blood transfusion. His works include *Blood Groups and Transfusion* (3rd ed., 1943), *The Rh-Hr Blood Types* (1954), and *Advances in Blood Grouping* (3 vol., 1961, 1965, 1970).

WIENER, Norbert (1894–1964), American mathematician, born in Columbia, Mo., and educated at Tufts College and at Cornell, Harvard, Cambridge, Göttingen, and Columbia universities. A mathematical prodigy, he entered college at the age of eleven and received his doctorate before he was nineteen. He became assistant professor of mathematics at the Massachusetts Institute of Technology in 1919 and was professor from 1932 to 1960.

Wiener specialized in the application of mathematical computations to solve problems in various fields of science, including the probability, quantum, and relativity theories in mathematics and physics (qq.v.); see *PROBABILITY*; *QUANTUM THEORY*; *RELATIVITY*. During World War II, while engaged in research into antiaircraft-defense techniques, he attempted to produce a mathematical and electronic system for commu-

nicating vital information, and also an automatic control mechanism to regulate the system; see *ELECTRONICS*. See also *AUTOMATION*; *SERVOMECHANISM*.

He thus founded the study of cybernetics (q.v.), which deals not only with the automatic control of machinery by computers and other electronic devices, but also the study of the human brain and nervous system (qq.v.), and the interrelationship between the two communication and control systems; see *COMPUTER*. Wiener summarized his theories in *Cybernetics* (1948), and also wrote *The Human Use of Human Beings* (1950), *Nonlinear Problems of Random Theory* (1958), *The Tempter* (1959), and *God and Golem, Inc.* (1964).

WIENIAWSKI, Henri (1835–80), Polish violinist and composer, born in Lublin. At the age of eight he entered the Paris Conservatory, where he studied with the Belgian violinist Lambert Massart (1811–92). He made his debut in 1848 and two years later undertook a series of European concert tours. Wieniawski became violinist to the Russian emperor in 1860 and taught at the Saint Petersburg (now Leningrad) Conservatory from 1862 to 1869. From 1872 to 1874 he toured the United States, making frequent appearances with the Russian pianist Anton Rubinstein (q.v.). One of the greatest violinists of his time, he popularized the use of *vibrato* (see *HARMONICS*) as an element of tone in violin playing. Until his time, *vibrato* had been used only as a special effect. His compositions have lost much of their once great popularity, although the two violin concertos and the *Légende* for violin and orchestra (1859) still appeal to violin virtuosos because of their Slavic coloring and opportunities for bravura display.

WIESBADEN, city in West Germany, and capital of Hesse State, at the s.w. base of the Taunus mountain range, on the Rhine R., about 20 miles w. of Frankfurt. Famed for its hot mineral springs and mild climate, it is one of the leading watering places of Europe. The city is an important transportation center, does a large business in wine, and has factories producing chemicals and pharmaceuticals, cement, metal goods, machinery, surgical instruments, and textiles. Among the places of interest, many of which suffered damage during World War II (q.v.), are the Nassau state library, the former royal and ducal residences, the Kurhaus with its casino and its concert halls, the Colonnade, and remnants of a Roman wall known as the *Heidenmauer* ("heathen's wall"). The Hessian State Theater is the meeting place for artists and visitors from all over the world.

History. The Celts founded a settlement on the site of present-day Wiesbaden about the 3rd century B.C. In later times it was used as a spa and fortified by the Romans, who called it *Aquae Mattiacorum*. The name *Wisibada* ("meadow bath") came into use in the 9th century. In the 11th century the city became a possession of the Nassau family. It served as the capital of the duchy of Nassau from 1815 to 1866, when it became part of the Prussian province of Hesse-Nassau. Captured by American forces in 1945, during World War II, the city was included within the American zone of occupation. It was made capital of the new State of Hesse in 1946. Pop. (1970) 250,700.

WIG, hairlike covering for the head, made either of artificial or real hair (q.v.), worn in most cases today by men to compensate for baldness and by women for adornment, variety, or convenience. Throughout history wigs have also been worn for protection from the sun, to avoid social ostracism when baldness was associated with disease or deformity, to signify professional or ethnic identity, and to emphasize high social station. They were worn by men and women of ancient Greece and Rome and reached their greatest popularity and extravagance in the Western world during the 16th, 17th, and 18th centuries, when powdered wigs and coiffures were in vogue for both sexes. Perukes, long wigs widely worn in the 17th century, are still worn by British barristers in court. Wigs have always been and continue to be indispensable parts of costuming in most theatrical and related productions.

In modern times wigs have been more euphemistically referred to as hairpieces, toupees (for men), and transformations, falls, and chignons (for women). The wearing of wigs has increased greatly in recent years with the emergence of more varied attitudes toward fashion. Along with the marketing of relatively inexpensive hairpieces to the general public, techniques for the regrowth, implanting, or transplanting of human hair have also been improved and developed into successful businesses.

See **COSTUME**; **HAIRDRESSING**.

WIGAN, Great Britain, county borough of Lancashire, England, 17 miles N.E. of Liverpool. Wigan is a rail and industrial center, connected by canal with Liverpool and Manchester. Textile manufacturing, cannel-coal mining, and iron-working are the principal industries, and there are plants producing railroad cars, hardware, petroleum products, chemicals, and explosives. As early as the 17th century Wigan attained repute for its metal trades, especially bell founding and

pewter making. Educational institutions in Wigan include a college of mining and technology, and a grammar school founded in the 16th century. The public library contains a valuable collection of works on mining. Among the principal landmarks is All Saints Church, which is noted for its Norman tower. Chartered in 1246 by King Henry III (q.v.), Wigan is the oldest borough in Lancashire. Pop. (1971) 81,258.

WIGGIN, Kate Douglas (1856–1923), American writer and educator, born Kate Douglas Smith in Philadelphia, Pa., and educated privately. In 1878 she organized in San Francisco the first free kindergarten on the West Coast, and in 1880, with her sister Nora Archibald Smith (1854–1934), she founded the California Kindergarten Training School for teachers. Mrs. Wiggin wrote several books of juvenile fiction that achieved enormous popularity, including *The Birds' Christmas Carol* (1887), *Timothy's Quest* (1890), *Rebecca of Sunnybrook Farm* (1903), and *Mother Carey's Chickens* (1911). In collaboration with her sister she also wrote many books on education.

WIGGLESWORTH, Michael (1631–1705), American clergyman and poet, probably born in Yorkshire, England, brought to America at the age of seven, and educated at Harvard College. After about 1656, when he was ordained as a Congregational minister, he held a pastorate in Malden, Mass. Wigglesworth is remembered chiefly for his *Day of Doom* (1662?), a long theological poem in ballad meter. Written to instruct his congregation, the work achieved wide popularity. His other writings include *Meat Out of the Eater or Meditations Concerning the Necessity, End, and Usefulness of Afflictions Unto God's Children* (1669), another theological poem that was greatly popular.

WIGHT, ISLE OF (anc. *Vectis*), Great Britain, island and administrative county of England, formerly part of Hampshire, in the English Channel and separated from the English mainland by the Solent and Spithead channels. Its principal physical feature is an undulating range of chalk downs from 400 to 700 ft. in height and traversing the island from E. to W. There are several small rivers, including the Medina and the Yar. Because of its interesting geological formations, beautiful scenery, and mild climate, the island is a popular health and vacation resort. Sheep raising, dairying, and the growing of fruit and vegetables are the chief occupations of the inhabitants. Boat building and the manufacture of cement are important industries.

Points of interest include the Needles, three pointed, chalk formations, about 100 ft. high,

lying off the westernmost tip of the island; various British and Roman antiquities; several Norman churches; the ruins of Carisbrooke Castle, in which the English king Charles I (q.v.) was imprisoned (1647–48); Farringford, the estate of the British poet Alfred Tennyson (q.v.); and Osborne House, formerly a royal residence, in which Queen Victoria (q.v.) died, and now a naval convalescent home.

Newport is the county seat. The chief port is Cowes, a noted resort and headquarters of the Royal Yacht Squadron. Other resorts are Ryde and Sandown-Shanklin. Ferry service is maintained between island ports and the English mainland.

The Isle of Wight was conquered by the Romans in 43 A.D.; in 661 it was annexed to the kingdom of Wessex. The island later became part of Sussex, and during the three centuries preceding the Norman conquest of England it was repeatedly devastated by Danish pirates. In 1377, 1419, and 1545 it was invaded and pillaged by the French; thereafter the island was well fortified. Area, 147 sq.mi.; pop. (1971) 109,284.

WIGNER, Eugene Paul (1902–), American physicist, born in Budapest, Hungary. He received a doctorate in engineering from the Technische Hochschule, Berlin, in 1928. He joined the faculty of Princeton University in 1930, and was appointed professor of physics there in 1938. He became a United States citizen in 1937. Wigner was one of five scientists who informed President Franklin D. Roosevelt in 1939 of the possible military use of atomic energy, and during World War II he helped design the plutonium reactors at Hanford, Wash. Wigner won the Enrico Fermi award in 1958, presented by the Atomic Energy Commission. He shared the 1963 Nobel Prize in physics with Maria Goeppert Mayer and Johannes Hans Daniel Jensen (qq.v.) for his work in elucidating the structure of the atomic nucleus and his development of quantum mechanics theory concerning the nature of the proton and neutron. With the American physicist Alvin Martin Weinberg (q.v.) he wrote *The Physical Theory of Neutron Chain Reactors* (1958).

WIGTOWN, Great Britain, county of Scotland, on the North Channel, in the w. district of Galloway (q.v.). The county is deeply indented, notably by Loch Ryan in the n.w., and by Wigtown Bay and Luce Bay in the s. The chief river is the Cree. The surface is hilly, and rocky moorlands occupy nearly half of the area, but there are fertile tracts in the s. and w. Almost the entire industry is agricultural; oats are the principal crop. Cattle raising is important. Wigtown is rich in

archeological remains, including hill forts, monoliths, and Pictish lake dwellings. Stranraer is the largest town and principal port; Wigtown is the administrative center. Area, 487 sq.mi.; pop. (1971) 27,341.

WIGWAM, primitive, usually dome-shaped dwelling used by American Indians, chiefly by Algonquian (q.v.) tribes of the Eastern woodlands of the United States. Generally larger than the conical tepee (q.v.), the wigwam was constructed of an arched pole framework covered by bark, hides, or mats of reeds. The huts were sometimes conical or rectangular in shape, however, and small wigwams for single families were not uncommon. See AMERICAN INDIANS: *Indians of the United States and Canada: Eastern Woodland Area*.

WILBERFORCE, William (1759–1833), British statesman and reformer, born in Hull, England, and educated at the University of Cambridge. In 1780 he was elected to Parliament, where he was an eloquent supporter of the liberal program advocated by the British statesman and leader the younger William Pitt (see under PITT). Wilberforce embraced Evangelical Christianity in 1784 and subsequently devoted himself to the social reform activities of the sect. The fight to abolish the slave trade soon attracted him, and he became the movement's chief spokesman in the House of Commons. In 1807 he secured enactment of legislation prohibiting the trade. He subsequently joined the struggle for the complete abolition of slavery and in 1823 was a founder of the Anti-Slavery Society. Ill-health forced his retirement from Parliament in 1825. The Emancipation Bill abolishing slavery became law one month after his death. Wilberforce was prominently identified with other liberal causes, notably the fight for Roman Catholic emancipation; see CATHOLIC EMANCIPATION ACT.

WILDCAT, name applied commonly to various species of small, undomesticated carnivores belonging to the family Felidae (q.v.). The European wildcat, *Felis sylvestris*, is larger and stronger than the domestic cat and has a shorter, thicker tail. In coloration it resembles the striped tabby cat. Formerly numerous in the mountain woodlands of Europe and in western portions of Asia, the species is now nearly extinct. It is a nocturnal prowler of vicious temperament and preys upon rodents, game birds, and other animals. The European wildcat is not believed to be a direct ancestor of the house cat, although it may have contributed in part to some varieties by an occasional cross; see CAT, DOMESTIC.

WILDE

The American species most commonly called wildcat is the lynx, *Lynx canadensis*; see LYNX. Native to North America, it ranges throughout the east as far north as Nova Scotia. This wildcat averages about 3 ft. in length and weighs about 25 lb. It has thick, reddish-brown fur, spotted with dark markings. Despite its comparatively small size, it is a fierce fighter and its strength is proverbial. It feeds chiefly on rodents and birds, although it also attacks such large animals as sheep and deer. Trappers hunt the lynx for its fur, which is used in trimmings. A similar species, the bobcat, *L. rufus*, is distributed over southern Canada, the entire United States, and northern Mexico.

WILDE, Oscar, in full OSCAR FINGAL O'FLAHERTIE WILLS WILDE (1854–1900), Irish author, born in Dublin, and educated at Trinity College, Dublin, and Magdalen College, University of Oxford. His literary work encompassed



Oscar Wilde

British Information Services

several genres: the story, the novel, poetry, and the drama; with the last Wilde made his greatest impact.

Life. As a youngster Wilde was exposed to the brilliant literary talk of the day at his mother's Dublin salon. Later, at Oxford, he excelled in classics, wrote poetry, and extended the Bohemian life style of his youth into a unique way of life. As the chief proponent of an aesthetic cult rooted in his philosophy "art for art's sake", the seemingly eccentric young Wilde wore his hair

long and his velvet breeches to the knee. His rooms were filled with various objects d'art—sunflowers, peacock feathers, blue china. Wilde claimed to aspire to the perfection of the china. His attitudes and manners were ridiculed in the pages of the comic periodical *Punch* and satirized in the Gilbert and Sullivan comic opera *Patience* (1881). Nonetheless, his wit, brilliance, and general flair won him many devotees.

Wilde's first published book was *Poems* (1881). His first play, *Vera, or the Nihilists* (1882) was produced in New York City the following year. The author saw it there while on a highly successful lecture tour of the United States. Upon returning to England he indulged himself in extravagant living. Settling in London, he married in 1884 a wealthy Irish girl, with whom he had two sons. Thereafter he devoted himself exclusively to writing.

In 1895, at the peak of his career, Wilde became the central figure in one of the most sensational court trials of the century. The results scandalized the Victorian middle class; Wilde was convicted on moral grounds for sodomy. Sentenced to two years of hard labor in prison, he emerged financially bankrupt and spiritually downcast. He spent the rest of his life in Paris, France, using the pen name Sebastian Melmoth. He died of meningitis in Paris, having been received into the Roman Catholic Church.

Fiction. Wilde's early published works included two collections of fairy stories, *The Happy Prince and Other Tales* (1888) and *A House of Pomegranates* (1892), and a group of short stories, *Lord Arthur Savile's Crime* (1891). His only novel, *The Picture of Dorian Gray* (1891), is a melodramatic tale of moral decadence, distinguished for its brilliant, epigrammatic style. Although the author fully describes the process of corruption, the shocking conclusion of the story frankly commits him to a moral stand against self debasement.

Drama. Wilde's first dramatic venture following *Vera* was *The Duchess of Padua*, a blankverse tragedy produced in New York City in 1891. His most distinctive and engaging creations in the dramatic form, however, are the four comedies *Lady Windermere's Fan* (1892), *A Woman of No Importance* (1893), *An Ideal Husband* (1895), and *The Importance of Being Earnest* (1895), all characterized by adroitly contrived plots and remarkably witty dialogue reminiscent of the 17th-century comedy of manners; see DRAMA. Wilde, with little dramatic training, proved he had a natural talent for stagecraft and theatrical effects, and most importantly, a true gift for farce. The plays sparkled

with his clever paradoxes, among them, such famous inverted proverbs as "Experience is the name everyone gives to their mistakes", and "What is a cynic? A man who knows the price of everything, and the value of nothing".

In contrast, Wilde's *Salome* was a serious drama about obsessive passion. Originally written in French, it was produced in Paris in 1894 with the celebrated French actress Sarah Bernhardt (q.v.) in the title role; the play had been banned in England. It was subsequently made into an opera, with a score written by the German composer Richard Strauss (q.v.).

The Final Years. While in prison Wilde composed *De Profundis* ("From the Depths"; posthumously published, 1905), an apology for his life. Some critics consider it a serious revelation; others, a sentimental insincere work. *The Ballad of Reading Gaol* (1898), written at Berneval, France, just after his release and published anonymously in England, was the most powerful of all his poems. The starkness of prison life and the desperation of men interned is revealed in beautifully cadenced language: "How else but through a broken heart/May Lord Christ enter in?" For years after his death the name of Oscar Wilde bore the stigma attached to it by Victorian prudery. Wilde, the artist, now is recognized as a brilliant epigrammatist and social commentator, whose best work is viable today.

WILDEBEEST. See GNU.

WILDER, Billy (1906–), American motion-picture director, writer, and producer, born in Vienna, Austria. He studied law for a year at the University of Vienna and worked in Berlin as a crime reporter before he became involved in motion pictures. One of his first writing efforts was a screenplay for the avant-garde German film *Emil, the Detective* (1931).

Wilder emigrated to the United States in 1934 and became a U.S. citizen in 1940. Since 1936 he has worked for several American studios on many critically acclaimed and popular films. In a number of these motion pictures he dealt with sophisticated comic and love themes; in others, with realistic subjects such as the effects of alcoholism, war, or murder on human relationships. He collaborated on the writing of the romantic film *Ninotchka* (1939); the murder stories *Double Indemnity* (1945) and *Witness for the Prosecution* (1958), which he also directed; the gripping prisoner-of-war film *Stalag 17* (1953) and the romantic comedies *Sabrina* (1954) and *Some Like It Hot* (1959), which he also produced and directed; and *The Seven Year Itch* (1955), which he also coproduced and directed. Wilder has received awards, popularly called Oscars, from the

Academy of Motion Picture Arts and Sciences for directing and coauthoring *The Lost Weekend* (1945), *Sunset Boulevard* (1950), and *The Apartment* (1960). For *Avanti* (1972), Wilder was producer, director, and coauthor of the screenplay.

WILDER, Thornton Niven (1897–1975), American author, born in Madison, Wis., and educated at Oberlin College and Yale University. His teaching career, at a preparatory school in New Jersey and at the University of Chicago, ended in 1936. Meanwhile he had achieved success as both novelist and playwright. His first published novel was *The Cabala* (1926). For his second novel, *The Bridge of San Luis Rey* (1927), he was awarded the 1928 Pulitzer Prize in fiction; in this compelling work Wilder united the lives of a disparate group of travelers in colonial Peru through a single event, the disaster in which they die. His other novels include *The Ides of March* (1948), an epistolary work about the Roman statesman Gaius Julius Caesar (q.v.), and *The Eighth Day* (1967), about the events surrounding a murder. For the latter work Wilder was awarded the 1968 National Book Award in fiction. Another novel, *Theophilus North* (1973), is actually a group of short stories.

Wilder's direct, accessible style works equally well in the field of drama. His first play, the allegorical *The Trumpet Shall Sound* (1926), was followed by a long list of popular one-act plays and translations of European plays. An enduring work of American drama is Wilder's *Our Town* (1938). This charming and touching look at small-town American life brought Wilder the 1938 Pulitzer Prize in drama. It was theatrically experimental, performed on a stage without scenery, using stepladders to represent the upstairs of a house and folding chairs to indicate a graveyard. For his play *The Skin of Our Teeth* (1942), a hilarious view of human life through the ages, Wilder won the 1943 Pulitzer Prize.

One of Wilder's most successful works, *The Matchmaker* (1954), had an interesting evolution. It was a revision of his early play, *The Merchant of Yonkers* (1938), that he had adapted from a work by the Austrian playwright Johann Nepomuk Nestroy (1801–62) entitled *Einen Jux Will Er Sich Machen* ("He Wants To Have a Fling", 1842), itself an adaptation of the farce *A Day Well Spent* (1835), written by the British playwright John Oxenford (1812–77). Made into a motion picture in 1958, *The Matchmaker* was adapted in 1964 as a musical comedy entitled *Hello, Dolly!*, which was in turn made into a motion picture in 1969.

Wilder also wrote a cycle of one-act plays,

WILDERNESS, BATTLE OF THE

three of which were produced (1962) in New York City under the collective title *Plays for Bleecker Street*; these were *Someone from Assisi*, *Infancy*, and *Childhood*. Like most of Wilder's best work, they deal in simple terms with the fundamental, and at the same time most profound, aspects of life.

WILDERNESS, BATTLE OF THE, battle of the American Civil War, fought on May 5–6, 1864, in a densely thicketed woodland, known as the Wilderness, in northeast Virginia. The engagement involved the Army of Northern Virginia, about 62,000 troops under the Confederate general Robert E. Lee (see *under* **LEE**), and the Army of the Potomac, about 118,000 troops under the Union general George Gordon Meade (q.v.). The Union commander in chief, General Ulysses Simpson Grant (q.v.), directed Meade's command during the fighting. Determined to sever Lee's lines of communication with Richmond, Va., capital of the Confederacy (see **CONFEDERATE STATES OF AMERICA**), Grant sent his army across the Rapidan R. during the night of May 3, with the intention of moving through the Wilderness into battle positions under cover of darkness. Transport failure kept the Union army in the forest throughout May 4. On the morning of May 5, Lee prepared to attack. Planning to flank the Union line, Lee marched on Grant's forces with two infantry corps, under the Confederate generals Richard Stoddert Ewell and Ambrose Powell Hill (qq.v.). Lee delayed going into action until another infantry corps, under General James Longstreet (q.v.), could be brought up to support Ewell and Hill. Informed of Lee's preparations, Grant took the initiative and attacked first. Two Union infantry corps opened the battle with an attack against Ewell, and one remained temporarily in reserve; a fourth, under the command of General Ambrose Everett Burnside (q.v.), was located too far north of the battlefield to be brought immediately into action.

Communication difficulties split the battle into disjointed engagements. The terrain precluded effective use of cavalry or artillery. The infantry fighting, much of it hand to hand, was declared by Grant to be the hardest he had ever seen. The forest caught fire, burning many men to death. In the action on May 5, the Confederate forces under Ewell and Hill repulsed Union forces in the morning. In the afternoon the Union reserve corps under General Winfield Scott Hancock (q.v.) launched an attack on Hill's forces, inflicting heavy Confederate losses in a 4-hr. fight with the firing lines only 50 yd. apart. The Union assault ended, however, without success.

On May 6, Grant renewed the Union drive against Hill, with Hancock attacking again while the other two Union corps blocked Ewell. Hill's defeat appeared certain until Longstreet's corps hurried in and saved the Confederate situation. Burnside, coming to help Hancock with Union reinforcements, arrived too late because of the difficult terrain.

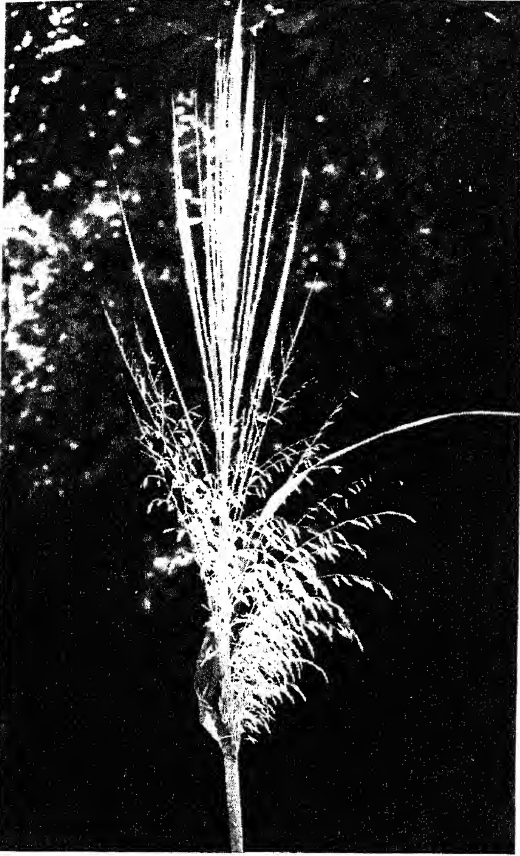
The two-day battle ended at nightfall without decisive outcome. During the night of May 6, General Philip Henry Sheridan (q.v.), commanding a Union cavalry corps, fought to some advantage against a Confederate cavalry corps of two divisions led by General James Ewell Brown ("Jeb") Stuart (q.v.), but the action was inconsequential. On May 7 and 8, Grant withdrew toward Spotsylvania (q.v.), followed by Lee, who engaged him there on May 10. Union losses were about 18,000 and Confederate losses about 7750. The site of this and several other battles of the Civil War is included in the Fredericksburg and Spotsylvania County Battlefields Memorial National Military Park, established in 1927.

See **CIVIL WAR, THE AMERICAN**: *Military Operations*. See also **COLD HARBOR, BATTLE OF**.

WILDERNESS ROAD, path following buffalo traces and Indian trails, more than 200 mi. long, extending from the Holston R. valley in western Virginia, through eastern Tennessee, northward over the Cumberland Plateau, through the Cumberland Gap (qq.v.), and ending in central Kentucky. Part of the Wilderness Road was explored in 1750 by Thomas Walker (1715–94). Its entire length was explored by Daniel Boone (q.v.) in 1769. Six years later Boone, with a party of thirty axmen, cleared and marked the route for the Transylvania Company, which was acquiring land for a new colony in Kentucky; see **KENTUCKY**: *History*.

For some fifty years after Boone's pioneering, Wilderness Road, sometimes called Boone's Trace, was the principal migration route for some 200,000 settlers of Tennessee and Kentucky. Other routes eventually branched off, one westward to the Cumberland R. at Nashville, and another northward to Louisville. Although the road was made passable for wagons in 1795 and improved again in 1818, it fell into disuse until the establishment of the present highway system. Some of the main automobile highways follow the original route.

WILD RICE, or **INDIAN RICE**, common name applied to an annual, aquatic grass, *Zizania palustris*; see **GRASSES**. The plant, which is also known as water oats, is found growing wild in swamps and shallow water in eastern United States, often reaching a height of 9 ft. Seeds of



Wild rice, *Zizania palustris*

Hugh Spencer -
National Audubon Society

wild rice attract great numbers of fish and waterfowl; for that reason, the grass is widely planted in ponds and marshes by sportsmen. Wild rice is also harvested and sold for human consumption, being threshed from the plant directly into boats.

WILEY, Harvey Washington (1844–1930), American chemist, born in Kent, Ind., and educated at Hanover College, the Medical College of Indiana (now Indiana University Medical Center), and Harvard University. From 1874 to 1883 he taught chemistry at Purdue University and served as State chemist of Indiana. He then was chief chemist of the United States Department of Agriculture until 1912. From 1899 to 1914 Wiley also taught agricultural chemistry at George Washington University. Much of Wiley's life was devoted to a zealous campaign against food adulteration. He was responsible for the passage of the first pure food and drugs law by the United States Congress in 1906.

WILFRID, Saint or **WILFRITH, Saint** (634–709) English prelate, born of noble Northumbrian

parentage. He was educated at the abbey at Lindisfarne, or Holy Island, an island in the North Sea about 1 mi. off the coast. Wilfrid was a figure in the changes in the Christian Church in what is now Great Britain from Celtic to Roman forms of worship and organization; see CHURCH OF ENGLAND; CUTHBERT, SAINT. He was abbot of the monastery of Ripon from about 661 to 665. Ordained to the priesthood in 663, Wilfrid participated in the Synod of Whitby in 664, held under the auspices of Oswy, King of Northumbria (about 612–70), and convoked to settle the vexing question of the dating of Easter (q.v.). Wilfrid persuaded Oswy to substitute Roman for Celtic usages, which had prevailed till then in Northumbria (q.v.), thus ending the dominance of the pro-Celtic prelates and assuring that the English church would go forward in the mainstream of Western Christianity. His traditional feast day is Oct. 12.

WILHELMINA, in full WILHELMINA HELENA PAULINE MARIA (1880–1962), Queen of the Netherlands (1890–1948), born in The Hague. In 1890, following the death of her father, King William III (q.v.), the last male member of the house of Orange-Nassau, Wilhelmina became queen and her mother, Queen Emma (1858–1934), was appointed regent. Because Luxembourg refused to recognize a woman ruler, the union of the grand duchy with the Netherlands was terminated in that year by Wilhelmina's accession. She was crowned on Sept. 6, 1898. In 1901 she married Henry, Duke of Mecklenburg-Schwerin (1876–1934). Wilhelmina vigorously supported Dutch neutrality during World War I. In World War II, after the German invasion of the Netherlands in 1940, she established a government-in-exile in England, where she became a symbol of Dutch resistance, remaining in contact with the Netherlands by radio. Wilhelmina returned to the Netherlands in 1945. On Sept. 4, 1948, because of ill-health after a reign of fifty years, she abdicated in favor of her only child, Princess Juliana (q.v.).

WILHELMSHAVEN, city and port of West Germany, in Lower Saxony, on the w. side of the entrance of the Jade Bay, an inlet of the North Sea, 40 miles N.W. of Bremen. The town, projected in 1856, is regularly laid out on a strip of land bought in 1853 by Prussia from Oldenburg. It was first used as a naval station in the Franco-German War (q.v.) of 1870–71, and subsequently was made into a fortress. The harbor basin is connected with the bay by a canal and contains three large dry docks. Wilhelmshaven remained an important naval base until the end of World War II. Pop. (1970) 103,000.

WILKES, Charles (1798–1877), American naval officer and explorer, born in New York City. He joined the United States Navy as a midshipman in 1818 and became a lieutenant in 1826. In 1830 he was made head of the newly established Depot of Charts and Instruments, which became the Naval Observatory (q.v.). He received command of a U.S. government expedition (1838–42) that explored the northwest coast of North America and the part of the coast of Antarctica that was subsequently named Wilkes Land (q.v.); charted almost 300 Pacific islands; and circumnavigated the globe. After his return Wilkes wrote *Narrative of the United States Exploring Expedition* (5 vol., 1844) and also edited twenty volumes of scientific data.

As commander of the frigate *San Jacinto* during the Civil War, on Nov. 8, 1861, he stopped at sea the British mail steamer *Trent* and removed from it James Murray Mason (1798–1871) and John Slidell (q.v.), the Confederate commissioners to Great Britain and France, respectively. This incident, the so-called *Trent* Affair (q.v.), nearly involved the Union in a war with Great Britain. Additional impulsive actions caused Wilkes to be court-martialed in 1864. He was retired the same year and commissioned to the rank of rear admiral two years later.

See also CIVIL WAR, THE AMERICAN.

WILKES, John (1727–97), British politician and reformer, born in London, England, and educated at the University of Leiden (now State University of Leiden) in the Netherlands. He was elected to Parliament in 1757. In 1762 he began to publish the anti-Tory weekly the *North Briton*; the forty-fifth issue, dated Apr. 23, 1763, which criticized a speech of George III (q.v.), King of Great Britain, caused Wilkes' imprisonment for seditious libel; see *Tory*. He was soon released on the grounds that his Parliamentary privilege had been violated. An obscene parody, *Essay on Woman*, which he printed privately in 1763 but which he apparently did not write, brought Parliamentary charges of libel and blasphemy, and he was expelled from Parliament. He went to France and, failing to return for trial, was outlawed. In 1768 he returned to England and was again elected to Parliament. Tried on the old libel charges, he was sentenced to prison and in 1769 again expelled from Parliament. His Middlesex constituents reelected him three times, but the House of Commons invalidated the election each time, the last time giving Wilkes' seat to his defeated opponent. This action caused riots among the lower and middle classes of London, who regarded Wilkes as the champion of civil rights. After his release from

prison late in 1769, he campaigned for widespread political reforms. He also championed the cause of the revolutionists in the American colonies and reputedly was British agent of the secret society called the Sons of Liberty (q.v.).

Supported by the powerful London merchant class and others who rallied to the slogan "Wilkes and Liberty!", he reached a peak of popularity, becoming successively alderman of London (1770), sheriff of London (1771), and lord mayor of London (1774). In the latter year he was elected to the House of Commons and seated without opposition. From 1779 to 1797 he was chamberlain of the city of London. In 1780, through his ruthless suppression of the anti-Roman Catholic Gordon riots, he lost much of his support; see CATHOLIC EMANCIPATION ACT; and under GORDON: *Lord George Gordon*.

WILKES-BARRE, city in Pennsylvania, and county seat of Luzerne Co., on the Susquehanna R., about 17 miles s.w. of Scranton, in the center of the Pennsylvania anthracite-coal region. Wilkes-Barre is a leading manufacturing and commercial center. In addition to coal mines, the surrounding area contains farms and numerous large manufacturing establishments. Industrial establishments in the city include textile mills, notably for rayon and nylon, and large railroad shops, and plants engaged in the manufacture of tobacco, food, lumber and paper products, iron and steel, electrical goods, pencils, and heavy machinery. Among the educational and cultural institutions in the city are Wyoming Seminary (1844), Wilkes College (1933), and King's College (1946); the library and museum of the Wyoming Historical and Geological Society; and the Municipal Conservatory, with exhibits of rare flowers and plants. The municipal park system covers approximately 500 acres.

History. Wilkes-Barre, in the Wyoming Valley (q.v.), was settled in 1769 by colonists from Connecticut. They were led by Major John Durkee (1728–82), a partner in the Susquehanna Company, which had purchased the site from the Indians. Durkee named the settlement in honor of John Wilkes and Isaac Barré (qq.v.), British political leaders who championed the rights of the American colonies in the House of Commons. Forts Durkee and Wyoming, now commemorated by monuments, were erected for the defense of the settlement. During the American Revolution (q.v.) Wilkes-Barre was burned by a British and Indian force on July 4, 1778, a day after the Wyoming Valley massacre. It was burned again in 1784 in the course of the so-called Pennamite-Yankee Wars. In the latter struggle rival groups of settlers from Connecticut

cut and Pennsylvania struggled for possession of a tract of land along the Susquehanna R. Wilkes-Barre became the county seat in 1786, was incorporated as a borough in 1806, and chartered as a city in 1871. In June, 1972, in the wake of hurricane Agnes, the Susquehanna R. topped 38-ft. dikes and caused heavy flooding and property destruction. Pop. (1970) 58,856.

WILKES LAND, coastal region of Antarctica, extending along the Indian Ocean from long. 102° E. to 142°20' E. The region lies between George V Coast on the E. and Queen Mary Coast on the W. Excluding Adélie Coast (q.v.), which is claimed by France, all of Wilkes Land and the adjoining hinterland form part of the antarctic claims of Australia. Wilkes Land was named in honor of the American naval officer and explorer Charles Wilkes (q.v.), who commanded the American expedition that discovered and cruised along most of the region in 1839. See *ANTARCTICA: Exploration: 19th Century*.

WILKINS, Sir George Hubert (1888–1958), Australian explorer, born in Mt. Bryan, near Adelaide, and educated at the Adelaide School of Mines. In 1912–13 he covered the Balkan Wars (q.v.) as a photographic correspondent, and from 1913 to 1917 he served as photographer with an expedition to the Canadian Arctic Regions led by the Canadian explorer Vilhjalmur Stefansson (q.v.). Wilkins served in the Australian Flying Corps during World War I. In 1920 he made his first expedition to Antarctica and in 1921–22 he was the naturalist on the last Antarctica expedition led by the British explorer Sir Ernest Henry Shackleton (q.v.). Wilkins was the leader of an expedition that made a biological survey of tropical Australia from 1923 to 1925. Returning to the Arctic Regions in 1926, he pioneered in aerial exploration of the polar regions. In 1928 he and a copilot flew from Point Barrow, Alaska, to the Spitsbergen archipelago, Norway. The 2100-mi. flight over largely unexplored arctic waters was the first to be made from North America to the European polar regions. Wilkins was knighted in 1928 for this feat. Later that year he made aerial explorations of Antarctica. In 1931 he made an unsuccessful attempt to explore the area under the North Pole in the submarine *Nautilus*. He was manager of the trans-Antarctica expeditions of the American explorer Lincoln Ellsworth (q.v.) from 1933 to 1939. During and after World War II he served as a consultant on arctic problems to the United States Army. He made his last trip, an exploration of Antarctica, in 1957. Wilkins' writings include *Undiscovered Australia* (1928), *Flying the Arctic* (1928), and *Under the North Pole* (1931). See

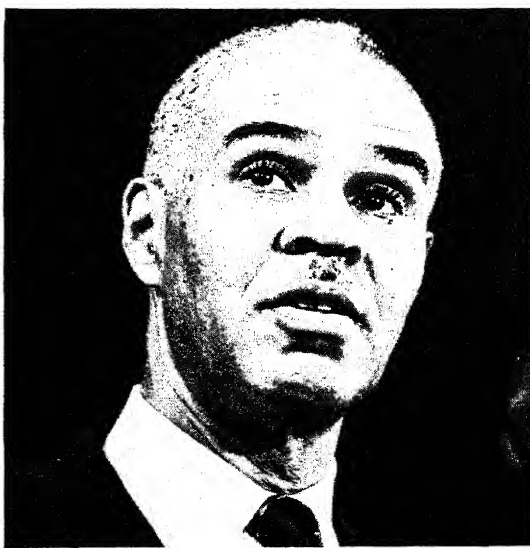
ANTARCTICA: Exploration; ARCTIC, THE: Exploration. **WILKINS, Mary Eleanor**. See *FREEMAN, MARY ELANOR*.

WILKINS, Maurice Hugh Frederick (1916–), British biophysicist, born in Pongaroa, New Zealand. He was educated at St. John's College, University of Cambridge, and received a Ph.D. degree from the University of Birmingham in 1940. He became a member of the Medical Research Council at King's College, London, in 1946, advancing to the position of deputy director in 1955. Wilkins studied the structure of the deoxyribonucleic acid (DNA) molecule by X-ray diffraction techniques and discovered that the molecule appeared to have a double spiral structure. On the basis of Wilkins' work, the American biochemist James Dewey Watson and the British biophysicist Francis Harry Compton Crick (qq.v.) evolved a theoretical helical structure of the DNA molecule. Wilkins, Watson, and Crick shared the 1962 Nobel Prize in medicine and physiology. See also *NUCLEIC ACIDS*.

WILKINS, Roy (1901–), American Negro civil-rights leader, born in Saint Louis, Mo., and educated at the University of Minnesota. From 1923 to 1931 he worked in Kansas City, Mo., on a newspaper for Negroes, becoming managing editor. In 1931 he was appointed assistant executive secretary of the National Association for the Advancement of Colored People (N.A.A.C.P.), the largest civil-rights organization in the United States. From 1934 to 1949 he was editor of *The Crisis*, the official magazine of the N.A.A.C.P. Wilkins served as a consultant to the War Department on Negro manpower during

Roy Wilkins

UPI



WILKINSBURG

World War II. After the war he continued his service to the N.A.A.C.P., and in 1965 became its executive director.

WILKINSBURG, borough of Pennsylvania, in Allegheny Co., 7 miles E. of Pittsburgh. It is chiefly a residential community with little industry and manufacturing. The borough was named for William Wilkins (1779–1865), secretary of war in the cabinet of President John Tyler (q.v.). Pop. (1960) 30,066; (1970) 26,780.

WILKINSON, Geoffrey (1921–), British chemist, born in England and educated at the University of London. He was associated with institutions such as the National Research Council of Canada, the University of California, the Massachusetts Institute of Technology, and Harvard University from 1943 until 1956, when he became professor of inorganic chemistry at the Imperial College of Science and Technology of the University of London. He shared the 1973 Nobel Prize in chemistry with the German chemist Ernst Otto Fischer (q.v.); they were cited for their individual study of how organic and metallic atoms can merge, work that has "revolutionized transitional metal chemistry".

WILKINSON, James (1757–1825), American soldier and adventurer, born in Benedict, Md. At the outbreak of the American Revolution (q.v.) he was commissioned captain in the Continental army. He participated in the Québec campaign of 1776 and the Battles of Saratoga in 1777; see SARATOGA, BATTLES OF. In 1778 Wilkinson became secretary of the board of war, but he was forced to resign the post and his brevet rank of brigadier general because of involvement in the intrigue against the American commander George Washington (q.v.) that became known as the Conway Cabal (q.v.). He was clothier general to the army from 1779 to 1781, when he returned to private life to avoid investigation of his accounts. In 1786 Wilkinson founded Frankfort, Ky. While living in Kentucky he allegedly conspired to detach the region from the United States and turn it over to the Spanish in Louisiana, hopeful of gaining a trade monopoly from the Spanish authorities in return. Rejoining the regular army in 1791 as a lieutenant colonel, he became a brigadier general in 1792 under General Anthony Wayne (q.v.). On Wayne's death in 1796, he succeeded him as commander in chief of the army. In 1803, after the Louisiana Purchase (q.v.), President Thomas Jefferson (q.v.) appointed Wilkinson one of the commissioners to receive Louisiana from the French, and he served as governor of Louisiana from 1805 to 1806.

A close associate of the former Vice-President

Aaron Burr (q.v.), Wilkinson reported Burr's conspiracy to gain control of Louisiana to President Jefferson and was the principal witness at Burr's trial in 1811. Wilkinson himself was deeply implicated in the plot, but a court martial acquitted him of complicity. In 1813, after the start of the War of 1812 (q.v.), Wilkinson advanced to the rank of major-general and received command of the American forces on the Canadian frontier. Unsuccessful in the campaign of 1813 against Montréal, he was summoned in 1815 before a court of inquiry on various charges, including neglect of duty. He was acquitted and honorably discharged from the army. From 1821 until his death Wilkinson lived in Mexico. His three-volume work *Memoirs of My Own Times* was published in 1816.

WILL, or LAST WILL AND TESTAMENT, in law, disposition by an individual of his property, intended to take effect after his death. A disposition of real property by will is termed a devise; a disposition of personal property by will is termed a bequest. The person making a will, called the testator, must have testamentary capacity, that is, he must be of full age and sound mind and must act without undue influence by others. By statute in the various States of the United States and in England, a will is required to be in writing, whether it disposes of real or personal property; a soldier or sailor in actual military service, however, may make a will orally. In a number of jurisdictions in the U.S., an oral will is also valid when made by a testator during sickness that terminates in his death, but it must be made at a point in the sickness when, because of the apparent imminence of death, neither time nor opportunity exists to make a written will. The law usually provides that the contents of an oral will must be reduced to writing within six days after it was declared in the presence of the statutory number of witnesses, usually three. Such oral wills are termed nuncupative wills, and may dispose only of personal property. A written will that is entirely in the handwriting of the testator is termed a holographic will and may dispose of real or personal property, or both. The statutes of some States in the U.S. recognize such wills as valid without formal execution or attestation, if wholly written, dated, and signed by the testator's own hand. A holographic will is valid only if it complies literally with the controlling statute.

Written Wills. A written will must be signed at the end of the instrument; a testator unable to write his name may make his mark by an "X", and such a mark is considered a valid signature. In the U.S. generally, two, and in some States,

three persons must witness the will, that is, they must sign the will as witnesses to the signature of the testator; see **WITNESS**. In most States the signing must be done in the presence of witnesses, and the testator must state that the document he is signing is his will. The witnesses need not be acquainted with one another and may sign at the same time or at separate times, depending on the statutory requirements of the State in which the will is executed; thus, the signature may, in most States, be written in the presence of one witness and acknowledged later by other witnesses.

All witnesses to a will must be competent. A witness who is a beneficiary under a will is considered incompetent because of his interest under the instrument; if one of the necessary witnesses is a beneficiary, the will is void. To remedy such situations, however, it has generally, though not universally, been provided by statute that a bequest to a subscribing witness shall be void, and that the will shall otherwise be valid.

Attestation. An attestation clause or a clause certifying the proper execution of the will must usually be added after the testator's signature. The following is a simple form of such a clause:

Signed, sealed, published, and declared
by Jane Doe, the testatrix, as her last will
and testament in the presence of us, who at
her request and in her presence and in the
presence of each other have hereunto sub-
scribed our names as witnesses.

A.B. residing at 1000 X Street, Blank City

C.D. residing at 1100 X Street, Blank City

As a rule, no particular form is prescribed by the various statutes for the preparation of a will so long as the testator's intent is disclosed by the writing.

Revocation. A will is revocable until the testator's death. The only exception to this occurs when two parties simultaneously make mutually irrevocable wills, in which they name one another as their respective beneficiaries and expressly give up the right to revoke their wills. A testator may revoke his will by destroying the entire instrument, as by burning it or tearing it up, or by obliterating his signature. Any part or the whole of the will may be revoked by a codicil, or an amendment to the will, executed with the same statutory formalities as the will itself. A valid later will revokes a prior will. Disposition of property by the testator before his death, as by gift or sale, is not a revocation of the will, although its effect may be similar to a revocation.

Marriage of the testator subsequent to the date of execution of his will revokes the will as to the surviving spouse or children, who are entitled to the same rights in the testator's estate as if he had died intestate, that is, without leaving a will.

Probate. No disposition of estate is made after the testator's death until the will is probated. The probate of a will is a court proceeding upon notice to the heirs and next of kin. Questions frequently arise about the construction of the terms of a will. The most important rule of construction is that the intention of the testator as it appears from the will shall be carried out whenever legally possible; when the will is ambiguous, the circumstances surrounding its execution may be examined in order to ascertain the testator's intention.

The statutes of each State must be consulted as to restrictions on a testator's disposition of his property by will. In many jurisdictions a will may not exclude a surviving spouse. The degree of participation of the spouse in the estate varies from State to State. Many jurisdictions, however, permit a person to exclude children from participation in his estate. See **EXECUTORY DEVISE**; **INHERITANCE**; **LEGACY**; **TRUST**, in law.

WILL, in philosophy and psychology, capacity to choose among alternative courses of action and to act on the choice made, particularly when the action is directed toward a specific goal or is governed by definite ideals and principles of conduct. Willed behavior contrasts with behavior stemming from instinct, impulse, reflex, or habit, none of which involves conscious choice among alternatives. Willed behavior contrasts also with the vacillations manifested by alternating choices among conflicting alternatives.

Until the present century most philosophers conceived the will as a separate faculty with which every person is born. They differed, however, about the role of this faculty in the personality makeup. For one school of philosophers, most notably represented by the German philosopher Arthur Schopenhauer (q.v.), a universal will is the primary reality and the individual's will forms part of it. In his view, the individual's will dominates every other aspect of his personality, his knowledge, his feelings, and his direction in life. A contemporary form of Schopenhauer's theory is implicit in some forms of existentialism (q.v.), as in the work of the French philosopher Jean-Paul Sartre (q.v.), which regards man's personality as the product of his actions and his actions as manifestations of his will to give meaning to the universe.

Most other philosophers have regarded the will as co-equal or secondary to other aspects of personality. For rationalist philosophers, such as the Greek Aristotle, the Italian Saint Thomas Aquinas, and the French René Descartes (qq.v.), the will is the agent of the rational soul in governing purely animal appetites and passions. Some empirical philosophers, such as the British David Hume (q.v.), discount the importance of rational influences upon the will; they think of the will as ruled mainly by emotion. Evolutionary philosophers, such as the British Herbert Spencer, and pragmatist philosophers, such as the American John Dewey (qq.v.), conceive the will not as an innate faculty but as a product of experience evolving gradually as the mind and personality of the individual develop in social interaction.

Modern Attitudes. Modern psychologists tend to accept the pragmatic theory of the will. They regard the will as an aspect or quality of behavior, rather than as a separate faculty. It is the whole person who wills. This act of willing is manifested by (1) the fixing of attention on relatively distant goals and relatively abstract standards and principles of conduct; (2) the weighing of alternative courses of action and the taking of deliberate action that seems best calculated to serve specific goals and principles; (3) the inhibition of impulses and habits that might distract attention from, or otherwise conflict with, goal or principle; and (4) perseverance against obstacles and frustrations in pursuit of goals or adherence to principles.

In part, strength of will may be a matter of inheritance. Some people appear to be born with greater powers of attention and control than others. Of decisive importance in developing a strong will are environmental influences, particularly the influences of the home, school, and church. The kind of upbringing that insists on the paramount importance of certain goals, ideals, and principles, will tend to produce strong wills. On the other hand, the kind of education that emphasizes instead the importance merely of "getting by", of adjusting readily, and of being "well liked", is much less likely to develop strength of will. Education of the second kind is increasingly prevalent in the 20th century.

A strong will can be developed only if all the prerequisite factors are favorable; a deficiency in but one factor may suffice to render a person weak willed. Among the common deficiencies that may lead to infirmity of will are absence of goals worth striving for or of ideals and standards of conduct worth respecting; vacillating at-

tention; incapacity to resist impulses or to break habits; and inability to decide among alternatives or to stick to a decision, once made.

See also FREE WILL.

V.F. **WILLAMETTE**, river of Oregon, formed by the confluence of headwaters that rise in the Cascade Range and unite in Lane Co., about 5 miles N. of Eugene. It flows N. and enters the Columbia R. a few miles above Portland; its length, including the headwaters, is about 294 mi. A canal near Willamette Falls makes the river navigable for small steamers as far as Eugene. The river is an important source of hydroelectric power and has valuable fisheries. The Willamette Valley is the most populated area of Oregon. Extremely fertile, it is noted for fruit-growing, dairying, and lumbering. Tributaries of the Willamette include the McKenzie, Clackamas, and Santiam rivers. The chief cities on its banks are Portland, Salem, Eugene, Corvallis, and Albany.

WILLARD, Emma (1787-1870), American educator, born EMMA HART in Berlin, Conn., and largely self-educated. She entered the teaching profession in 1803 and was principal of the Female Academy, Middlebury, Vt., from 1807 to 1809. In the latter year she was married to John Willard (d. 1825). Mrs. Willard established a boarding school for girls in Middlebury in 1814. Rejecting contemporary theory on female education, she included in her curriculum a number of subjects, such as mathematics and history, previously offered only in schools for men. Her *Plan for Improving Female Education* (1818), which proposed additional innovations, won the approval of the governor of New York, DeWitt Clinton (q.v.), and in 1819 she opened a girls' seminary in Waterford, N.Y., the first school in the country to offer a college-level education for women. In 1821 she founded the Troy Female Seminary (now the Emma Willard School) in Troy, N.Y.; she managed the school until 1838. In later years, Mrs. Willard traveled extensively, lecturing and counseling on public and female education. Besides a number of textbooks, she wrote *The Fulfillment of a Promise* (1831), a volume of verse remembered chiefly now for the poem "Rocked in the Cradle of the Deep".

WILLARD, Frances Elizabeth Caroline (1839-98), American educator and reformer, born in Churchville, N.Y., and educated at Northwestern Female College. In 1874 she gave up a successful teaching career to become secretary of the National Woman's Christian Temperance Union (q.v.). An indefatigable crusader on behalf of prohibition (q.v.), she was elected president of the W.C.T.U. in 1879,

founded the World's Woman's Christian Temperance Union in 1883, and was elected president of the latter organization in 1891. Frances Willard was identified also with the movement for woman suffrage and the Prohibition Party (q.v.), which she helped to organize in 1882. She became president of the National Council of Women in 1890. Her writings include *Woman and Temperance* (1883) and *Glimpses of Fifty Years* (1889).

WILLARD, Jess (1881–1968), American boxer, born on Potawatomi Indian land in Kansas. Willard became a professional boxer at the age of twenty-eight, after having been a farmer and a wagon-train handler. In 1915 he defeated the American boxer Jack Johnson (q.v.), world heavyweight champion, in Havana, Cuba, in a fight that lasted twenty-six rounds (1 hr. 44 min.). In 1919 Willard lost the title to the American boxer Jack Dempsey (q.v.) when he was unable to answer the bell that signaled the beginning of the fourth round. Willard fought in 36 fights, in which he scored 20 knockouts and was himself knocked out only twice. He worked briefly in circuses and silent movies.

WILLEMSTAD, city, port, and capital of the Netherlands Antilles, in the West Indies, on the Caribbean Sea, on the s.w. coast of Curaçao. It is a free port and has excellent harbor facilities. The principal industry is the refining and transshipment of petroleum, chiefly from Venezuela. The tourist trade is also important. Among the points of interest are Fort Amsterdam, the governor's palace, the town hall, Wilhelmina Park, an 18th-century Protestant church, and the Jewish cemetery (dating from 1650).

The city was settled by the Spanish in 1527 and taken by the Dutch in 1634. During the 17th and 18th centuries it was a center of the slave trade. Its later importance dates from 1916, when a petroleum refinery was established there. Pop. (latest census) 43,547.

WILLIAM, name of a number of European emperors and kings. Brief accounts of less important rulers are included in this article under the names of the countries they ruled. For information on the more important monarchs see separate biographical articles.

The English name William appears in Dutch as Willem, in German as Wilhelm, in Italian as Guglielmo, and in French as Guillaume.

ALBANIA

William of Wied, Prince, in full WILHELM FRIEDRICH HEINRICH (1876–1945), King (1914), nephew of Elizabeth (q.v.), Queen of Rumania, born in Neuwied, Prussia. In 1913, when Albania was made an autonomous country, the Euro-

pean powers offered William the throne of Albania. He was crowned in February, 1914. Unpopular with the Albanians, he was forced into exile in September, 1914, but did not abdicate. William served with the German army in World War I and later retired to his German estates.

ENGLAND

William I (1027–87). See WILLIAM I, King of England.

William II (1056?–1100). See WILLIAM II, King of England.

William III (1650–1702). See WILLIAM III, King of England, Scotland, and Ireland.

William IV (1765–1837). See WILLIAM IV, King of Great Britain and Ireland.

GERMANY

William of Holland (1227–56), King (1247–56). William, who was count of Holland, was chosen king of Germany in 1247 by the legate of Pope Innocent IV (d. 1254) in opposition to the excommunicated Frederick II (q.v.), Holy Roman Emperor, who was king of Germany since 1215. Frederick's supporters and Frederick's son Conrad IV (see under CONRAD), who succeeded to the imperial throne in 1250, kept William in Holland for most of his supposed reign. After Conrad's death in 1254 William generally was recognized as king by the German princes. He died in battle against the Frisians.

William I (1797–1888). See WILLIAM I, Emperor of Germany.

William II (1859–1941). See WILLIAM II, Emperor of Germany.

THE NETHERLANDS

William I (1772–1843). See WILLIAM I, King of the Netherlands.

William II (1792–1849). See WILLIAM II, King of the Netherlands.

William III (1817–90). See WILLIAM III, King of the Netherlands.

PRUSSIA

William I (1797–1888). See WILLIAM I, Emperor of Germany.

William II (1859–1941). See WILLIAM II, Emperor of Germany.

SCOTLAND

William (1143–1214). See WILLIAM THE LION, King of Scotland.

SICILY

William I (1120–66), King of Sicily (1154–66). The son of King Roger II (q.v.), William continued his father's policy of excluding the principal nobles from participation in the central government. Encouraged by Frederick I (q.v.), Holy Roman Emperor, and Manuel I Comnenus, Byzantine Emperor (see under MANUEL), the nobles rose in rebellion, but by 1160 William suc-

WILLIAM

ceeded in crushing them. He also helped to install Pope Alexander III (*see under* ALEXANDER) in the papacy against Frederick's opposition and the claims of several antipopes.

William II (about 1153–89), King of Sicily (1166–89), son of William I. In 1177 he was married to Joan (1165–99), daughter of Henry II (q.v.), King of England. William followed his father's policy of supporting the papacy against Emperor Frederick I but made peace with Frederick in 1184 in order to wage war against the Byzantines. He was defeated by the Byzantines in 1185.

William III (d. 1198?), King of Sicily (1194), son of the Norman crusader Tancred (q.v.), who became king when William II died without an heir. William III was an infant when he inherited his father's throne. He reigned for less than a year; in 1194 Henry VI (q.v.), Holy Roman Emperor, invaded Sicily and became its ruler.

WÜRTTEMBERG

William I (1781–1864), King of Württemberg (1816–64), son of Frederick William Charles, Duke of Württemberg, later King Frederick I (*see under* FREDERICK) born in Lüben, Silesia (now Lubin, Poland). In 1814–15 William commanded an allied army corps in the Napoleonic Wars (q.v.). After he ascended the throne, William proved to be a progressive ruler, and in 1819 he granted a liberal constitution that abolished serfdom and class privileges and encouraged education and industry. He defended the rights of the small German states against Austrian and Prussian aggression and championed Germanic union. Between 1828 and 1830 he worked for the formation of the German Zollverein, or customs union (q.v.). After 1848 fear of Prussian power led him gradually in an alliance with Austria.

William II (1848–1921), King of Württemberg (1891–1918). The grandson of William I, he fought on the Austrian side in the Seven Weeks' War (q.v.) of 1866 against Prussia, but later fought with the Prussians against France in the Franco-German War (q.v.) of 1870–71. During his reign he showed little interest in German politics, although he accepted a liberal revision of the constitution in 1906. William was compelled to abdicate in 1918 after the defeat of Germany in World War I (q.v.).

WILLIAM I, called **WILLIAM THE CONQUEROR** (1027–87), King of England (1066–87), born in Falaise, France. William was the illegitimate son of Robert I, Duke of Normandy (d. 1035), and Arletta, a tanner's daughter. Upon the death of his father, the Norman nobles, honoring their promise to Robert, accepted William as his successor. Rebellion against the young duke

broke out almost immediately, however, and his position did not become secure until 1047 when, with the aid of Henry I (q.v.), King of France, he won a decisive victory over a rebel force near Caen.

During a visit in 1051 to his childless cousin, the Saxon king Edward the Confessor (*see under* EDWARD), in England, William is said to have obtained Edward's agreement that he should succeed to the English throne. In 1053, defying a



William I, King of England

papal ban, William married Matilda of Flanders (d. 1083), daughter of Baldwin V, Count of Flanders (d. 1067), and a descendant of the Saxon king Alfred (q.v.), thereby strengthening his claim to the crown of England. Henry I, fearing the strong bond between Normandy and Flanders resulting from the marriage, attempted in 1054 and again in 1058 to crush the powerful duke, but on both occasions William defeated the French king's forces.

Conquest of England. About 1064, Harold, Earl of Wessex, later Harold II (q.v.), King of England, was shipwrecked and taken prisoner by William. He secured his release by swearing to support William's claim to the English throne. When King Edward died, however, the witenagemot (q.v.) elected Harold king. Determined to make good his claim, William secured the sanction of Pope Alexander II (d. 1073) for a Norman invasion of England. The duke and his army landed at Pevensey on Sept. 28, 1066. On Oct.

14, the Normans defeated the English forces at the celebrated Battle of Hastings, in which Harold was slain; see *HASTINGS, BATTLE OF*. William then proceeded to London, crushing the resistance he encountered on the way. On Christmas Day, he was crowned king of England in Westminster Abbey.

The English did not accept foreign rule without a struggle. William met the opposition, which was particularly violent in the north and west, with strong measures; he was responsible for the devastation of great areas of the country, particularly in Yorkshire, where Danish forces had arrived to aid the Saxon rebels. By 1070 the Norman conquest of England was complete.

William invaded Scotland in 1072 and forced the Scottish king Malcolm III MacDuncan (d. 1093) to pay him homage. During the succeeding years the Conqueror crushed all insurrections, including that incited in 1075 by Ralph de Guader, 1st Earl of Norfolk (fl. 1070) and Roger Fitzwilliam, Earl of Hereford (fl. 1070) and a series of uprisings in Normandy led by his eldest son Robert (1054?–1134), who later became Robert II, Duke of Normandy.

His Achievements. One feature of William's reign as king was his reorganization of the English feudal and administrative systems. He dissolved the great earldoms, which had previously enjoyed virtual independence, and distributed the lands confiscated from the English to his trusted Norman followers. He introduced the Continental system of feudalism (q.v.); by the Oath of Salisbury of 1086 all landlords swore allegiance to William, thus establishing the precedent that a vassal's loyalty to the king overrode his fealty to his immediate lord. The feudal lords were compelled to acknowledge the jurisdiction of the local courts, which William retained along with many other English institutions. The ecclesiastical and secular courts were separated, and the power of the papacy in English affairs was greatly curtailed. Another outstanding accomplishment was the economic survey undertaken and incorporated in the Domesday Book (q.v.) in 1086.

In 1087, during a campaign against Philip I, King of France (see under *PHILIP*), William burned the town of Mantes (now Mantes-la-Jolie). William's horse fell in the vicinity of Mantes, fatally injuring him. He died in Rouen on Sept. 7, and was buried at Caen in Saint Stephen's, one of the abbeys he and Matilda had founded at the time of their marriage as penance for their defiance of the pope. William was succeeded by his third-born son, William II (q.v.).

William was a man of extraordinary ability who was irreproachable in his private life and sincerely religious. A stern ruler, he maintained good order in his kingdom and commanded the respect of his subjects; however, he was also merciless in the suppression of political opposition. Because of his ascendancy over the feudal barons, he has been called one of the first modern kings and is generally regarded as one of the outstanding figures in western European history. See *ENGLAND: History: Norman England*.

WILLIAM II, called RUFUS (1056?–1100), King of England (1087–1100), born in Normandy. He was the third son of William I (q.v.), King of England, who on his deathbed named him as his successor in England, leaving the duchy of Normandy to his eldest son, Robert (1054?–1134). William Rufus, as he was known because of his ruddy complexion, was crowned in Westminster Abbey in 1087. In 1088 William's uncle Odo, bishop of Bayeux (1036?–97), led a rebellion of Norman barons who sought to unseat him in favor of Robert. William's English subjects, believing his promises of less oppressive taxation and more liberal laws, helped him quell the revolt. The king, despite his promises, continued to pursue a domestic policy that was harsh and venal.

William invaded Normandy in 1089, 1091, and 1094, winning some concessions from his brother Robert II, Duke of Normandy, each time. He forced the Scottish king Malcolm III (d. 1093) to pay him homage and in 1092 seized the city of Carlisle and other areas claimed by Malcolm in Cumberland and Westmorland. In 1096 Robert mortgaged Normandy to William in exchange for funds to finance a Crusade; see *CRUSADES*. William then fought to recapture lands his brother had lost as duke of Normandy and brought the county of Maine back under the rule of the duchy.

After the death in 1089 of Lanfranc (q.v.), the archbishop of Canterbury, William delayed naming a successor. He held open vacant bishoprics and enriched himself with church monies, incurring the displeasure of many ecclesiastics. In 1093 he selected the Italian abbot Anselm, later Saint Anselm of Canterbury (q.v.), as the new archbishop, but they quarreled over William's authority to control church appointments. See *ENGLAND: History: Norman England*.

William was killed while on a hunting trip in the New Forest in Hampshire. It is not known whether the slaying, which is traditionally ascribed to a Norman named Walter Tirel (d. after 1100), was accidental or intentional. William was buried at Winchester; he never married and



The coronation of William III and Mary II.

Bettmann Archive

had no children. His younger brother succeeded to the throne as King Henry I (q.v.).

WILLIAM III, sometimes called **WILLIAM OF ORANGE** (1650–1702), King of England, Scotland, and Ireland (1689–1702) and Stadtholder of the Netherlands (1672–1702), born in The Hague, Holland. He was the posthumous son of William II, Prince of Orange and Stadtholder of the Netherlands (1626–50), and Mary (1631–60), eldest daughter of the English king Charles I (q.v.). In 1672, after the invasion of the Netherlands by the French king Louis XIV (q.v.), the leadership of the Dutch statesman Jan De Witt (see under **DE WITT**) was repudiated and William was elected stadtholder, captain-general, and admiral. William fought the French with great resolution, even, in 1673, cutting dikes around Amsterdam to flood the surrounding countryside and halt the advancing French ar-

mies. The Dutch suffered severe reverses in subsequent battles. As a result of William's superior diplomacy, however, which also included the strengthening of ties with England by his marriage in 1677 to the English princess Mary (see **MARY II**), eldest daughter of his uncle, James, Duke of York, later King James II (q.v.), Louis XIV agreed to terminate the war on terms favorable to the Dutch.

King of England. In England after the accession of James II in 1685 there was fear that the king's policies were directed toward restoring the power of the Roman Catholic Church. On June 30, 1688, seven prominent Englishmen formally invited William, who was also the leading Protestant of Europe, to bring an army of liberation to England. William and a force totaling about 15,000 men landed at Torbay on Nov. 5, 1688. Most of the English nobility declared for William, and James fled to France. William accepted the Declaration of Rights (see **BILL OF**

RIGHTS) passed by the Convention Parliament, which met on Jan. 22, 1689, and on Feb. 13, William and Mary were proclaimed joint sovereigns of England. The so-called Glorious Revolution was effected without bloodshed.

Shortly thereafter the Scottish parliament accepted the new rulers. Predominantly Catholic Ireland, however, remained loyal to the deposed king and had to be taken by force. In 1690 William led the army that defeated James and his Irish partisans at the Battle of the Boyne; see *BOYNE, BATTLE OF THE*. William's reign continued to be marked by abortive Jacobite (q.v.) plots to restore James to the throne. After the death of Mary in 1694, William ruled alone.

In 1689, in pursuit of his policy of containing France, William had brought England into the League of Augsburg, thereafter known as the Grand Alliance (q.v.). For the next eight years he was embroiled in wars on the Continent. He managed by skillful diplomacy to hold the alliance together and, in 1697, under the terms of the Peace of Ryswick, Louis XIV of France surrendered much of the territory he had won and recognized William as the rightful king of England; see *RYSWICK, PEACE OF*.

At home William manifested virtually none of the acumen he displayed in foreign affairs. Although he was liberal in some things, it was not he but Parliament, to which he was often opposed, that brought about the reforms effected during his reign, such as the passing of the Bill of Rights, the establishment of the Bank of England, the introduction of ministerial responsibility in government, and the encouragement of a free press.

In 1701 William headed the second Grand Alliance, which became involved in the so-called War of the Spanish Succession; see *SPANISH SUCCESSION, WAR OF THE*. He died in 1702, before he could take an active part in the struggle. His wife's sister, Queen Anne (q.v.), succeeded to the throne.

See *ENGLAND: History: The Glorious Revolution*.

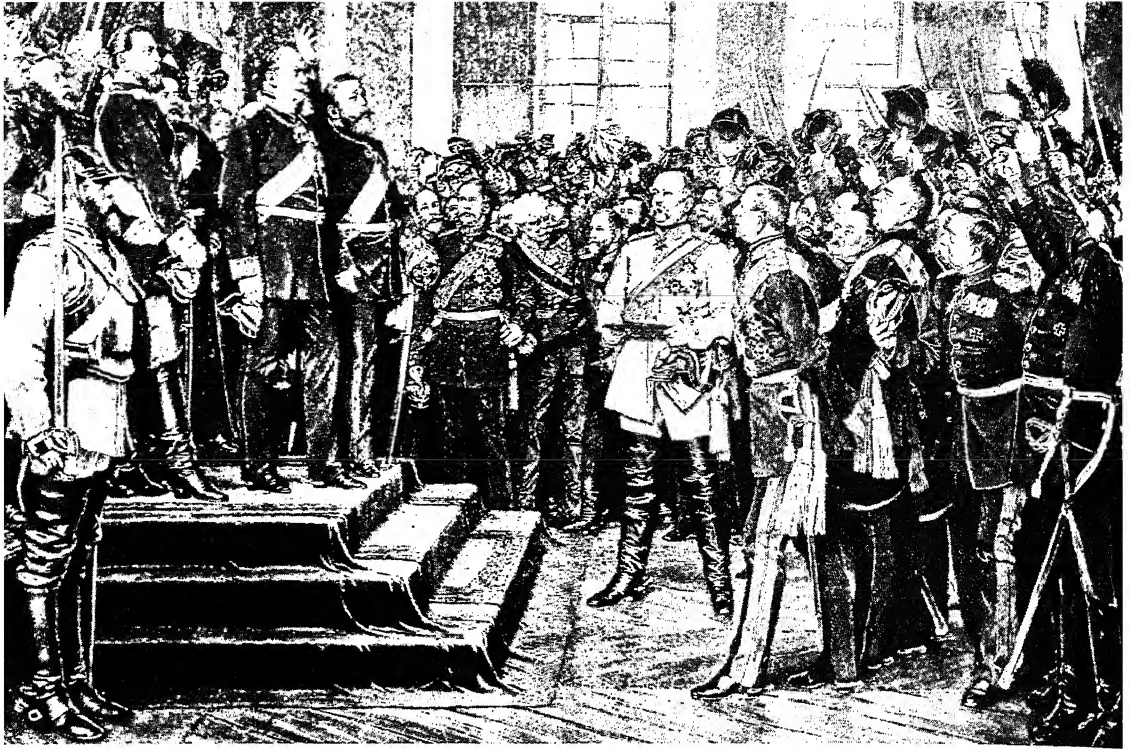
WILLIAM IV, (1765–1837), King of Great Britain and Ireland (1830–37) and King of Hannover (1830–37), born in London. The third son of King George III and younger brother of George IV (qq.v.), he entered the British navy in 1779, remaining in its service until 1787. He was created duke of Clarence in 1789. About 1791 he formed a liaison with the Irish actress Dorothea Jordan (1762–1816), by whom he subsequently had ten children. In 1818, after he unexpectedly came into the line of succession to the throne, he married a German princess, Adelaide of Saxe-

Meiningen (1792–1849), by whom he had two daughters, both of whom died in infancy. He became king in 1830, succeeding his brother.

Warmhearted and well intentioned but rather eccentric, William had virtually no political judgment. The major event of his reign was the passage of the Reform Bill of 1832 which he was persuaded to support by his prime minister, Charles Grey, 2nd Earl Grey (see *under GREY*); it was enacted after William finally agreed to create, if necessary, a sufficient number of new peers to overcome the majority opposed to the bill in the House of Lords; see *REFORM BILLS*. The abolition of colonial slavery (1833), the reform of the poor laws (1834), and the Municipal Reform Act (1835) were immediate results of the reform bill. He was the last British ruler to try to force Parliamentary acceptance of an unpopular ministry, namely the one headed by Sir Robert Peel (q.v.) in 1834–35. William was succeeded on the British throne by his niece Victoria (q.v.). The throne of Hannover (q.v.) was inherited by his brother Ernest Augustus (1771–1851). See *GREAT BRITAIN: History: The Reign of William IV*. **WILLIAM I**, in full *WILHELM FRIEDRICH LUDWIG* (1797–1888), Emperor of Germany (1871–88) and King of Prussia (1861–88), born in Berlin. The second son of Frederick William III (q.v.) and his queen Louise of Mecklenburg-Strelitz (1776–1810), he entered the Prussian army in 1807 and served in the Napoleonic Wars (q.v.). In 1829 he married Augusta of Saxe-Weimar (1811–90), by whom he had two children. Upon the accession of his childless brother Frederick William IV (q.v.) in 1840, William became heir presumptive to the Prussian throne. In 1858, after the king was declared insane, William became regent and three years later he succeeded to the throne. A firm believer in the divine right of kings, he declared at his coronation that he “ruled by favor of God, and of no one else”.

In 1862 he appointed the Prussian statesman Prince Otto von Bismarck (q.v.) his chief minister. Subsequently they embarked upon a program of unifying the German states under Prussian leadership. Their policies involved Prussia in war with Denmark in 1864 and with Austria in 1866. In 1867, after the defeat of Austria, William became head of the newly established North German Confederation (q.v.). During the Franco-German War (q.v.) he took personal command at the decisive Battle of Sedan (q.v.). He was proclaimed emperor of Germany in the palace at Versailles on Jan. 18, 1871, while his troops were laying siege to the city of Paris.

During his reign William firmly supported the militarism espoused by Bismarck as well as the



William I is proclaimed emperor of Germany in the Hall of Mirrors at the palace of Versailles, France.

UPI

latter's antidemocratic and anti-Catholic policies (see *KULTURKAMPF*). Two attempts to assassinate the emperor were made in 1878; on the second occasion he was seriously wounded. On his death ten years later, his son Frederick William succeeded him as Frederick III (q.v.). See *GERMANY: History: Rise of Nationalism*.

WILLIAM II, in full FRIEDRICH WILHELM VIKTOR ALBERT (1859–1941), Emperor of Germany and King of Prussia (1888–1918), born in Berlin, and educated at the University of Bonn. He was the son of Prince Frederick William, later Frederick III (q.v.) Emperor of Germany, and Victoria Adelaide Mary Louise (1840–1901), eldest daughter of Victoria (q.v.), Queen of Great Britain. In 1881, after a period of military service, he was married to the Augusta Victoria, Princess of Schleswig-Holstein (1858–1921). He became emperor in 1888 upon the death of his father, who had reigned for only three months.

William II's first major action as emperor was his dismissal in 1890 of the aged chancellor Prince Otto von Bismarck (q.v.), who had been largely responsible for the growth of the German Empire under the Emperor's grandfather William I (q.v.). Thereafter he participated significantly, often decisively, in the formulation of foreign and domestic policies. His administration of internal affairs was marked by the rapid

transformation of Germany from an agricultural to a major industrial state, and by the accompanying development of serious problems in capital-labor relations. William was only partially successful in his attempts to curb the growth of the socialist parties, which ultimately became the largest political group in the empire.

Imperialist Policies. The emperor believed that he ruled by divine right; foreign affairs interested him, but his policies in this were contradictory and confused. He professed deep friendship for Great Britain, but forced that country into an alliance with France and Russia by his aggressive program of colonial, commercial, and naval expansion. Similarly, his policy of friendship with Russia and support of Russian ambitions in the Far East was negated by his encouragement of Austro-Hungarian machinations in the Balkans. He believed firmly in the efficacy of the Triple Alliance (q.v.) as a deterrent to war, and there is little doubt he was devoid of militaristic ambitions. Nevertheless, imperial policy under his impulsive guidance severely aggravated the international frictions that culminated in World War I (q.v.).

During the war William's position became increasingly that of a figurehead. Realizing his own incapacity as a military leader, he more and more left the responsibility for military decisions to the German generals Paul von Hindenburg and Erich Friedrich Wilhelm Luden-

dorf (qq.v.). He ignored the 1917 peace resolutions submitted by the Reichstag and urged continuation of the war. Failure of the German offensive of 1918 brought mounting unrest to the German armies and people, and on Nov. 10 William left his country and went to Holland. During the peace negotiations at Versailles, various representatives of the victorious Allies urged vainly that William be extradited and tried as a war criminal; see VERSAILLES, TREATY OF. He spent his remaining years in complete seclusion at Doorn Castle in the Netherlands. After the death of the former empress in 1921, William married Hermine, Princess of Schönaich-Carolath (1887–1947). He lived to see the resurgence of German armed power, and on his death was buried with military honors by order of the German dictator Adolf Hitler (q.v.).

WILLIAM I, full Dutch name WILLEM FREDERIK (1772–1843), King of the Netherlands and Grand Duke of Luxembourg (1815–40), born in The Hague. He was the son of William V, Prince of Orange (1748–1806), the last hereditary stadtholder of the United Netherlands. In the War of the First Coalition during the Napoleonic Wars (q.v.) William commanded the Dutch army from 1793 until 1795, when his country was overrun by the French. He lived in exile, returning to the Netherlands in 1813. In 1815, by decision of the Congress of Vienna, the Netherlands and Belgium were united into a single kingdom and William was proclaimed its first king; see VIENNA, CONGRESS OF. In the same year he ceded his hereditary properties in Germany (see NASSAU) to Prussia, receiving in exchange the Grand Duchy of Luxembourg; see LUXEMBOURG: *History*. William soon estranged his Belgian subjects by his discriminatory policies and he was unable to prevent the secession of Belgium in 1830; see BELGIUM: *History*. He abdicated in favor of his son, William II (q.v.), in 1840, after repeated demands by his Dutch subjects for a liberalized constitution. Despite his reactionary policies, William greatly encouraged the agricultural and industrial development of the Netherlands.

WILLIAM II, full Dutch name WILLEM FREDERIK GEORGE LODEWIJK (1792–1849), King of the Netherlands and Grand Duke of Luxembourg (1840–49), the son of William I (q.v.), King of the Netherlands and Grand Duke of Luxembourg, born in The Hague, and educated at the University of Oxford. When the French overran the Netherlands in 1795, William and his family were exiled for eighteen years. He entered the British army in 1811 during the Napoleonic Wars (q.v.) and served as aide-de-camp

to General Arthur Wellesley, later 1st Duke of Wellington (q.v.). In 1815 William commanded the Dutch and Belgian forces at the Battle of Waterloo; see WATERLOO, BATTLE OF. In the same year his father became king of the Netherlands and Belgium.

In 1830, when the Belgians rebelled against Dutch rule, William advocated greater autonomy for them, but the king rejected his proposed concessions. In 1831 Dutch forces under the younger William's command subdued the Belgians. The next year France intervened on behalf of the Belgians, forcing William to withdraw, and in 1839 Belgium was granted independence. William succeeded to the throne upon the abdication of his father in 1840. The chief event of William II's reign was his granting of a liberalized constitution in 1848 that greatly abridged royal power; see NETHERLANDS, THE: *History: The 19th Century*. He was succeeded by his son William III (q.v.).

WILLIAM III, full Dutch name WILLEM ALEXANDER PAUL FREDERIK LODEWIJK (1817–90), King of the Netherlands and Grand Duke of Luxembourg (1849–90), the son of King William II (q.v.), born in Brussels, Belgium. He succeeded to the throne upon the death of his father. In 1866 William agreed to sell the Grand Duchy of Luxembourg to France, thus nearly provoking a war between France and Prussia. An international conference held in London the following year prevented war by declaring the grand duchy a neutral and independent state; see LUXEMBOURG: *History*. William's long reign was marked by uninterrupted peace and prosperity. He was succeeded by his daughter Wilhelmina (q.v.).

WILLIAM I, known as WILLIAM THE SILENT (1533–84), Prince of Orange and Dutch patriot, born in Dillenburg, in the Duchy of Nassau (now in West Germany), the son of William, Count of Nassau (d. 1559). He was raised as a Lutheran until the age of eleven, when he inherited considerable territory, including the French principality of Orange. Charles V (q.v.), Holy Roman Emperor, then insisted that he be educated at the imperial court as a Roman Catholic. In 1555 Philip II (q.v.), son and successor of Charles, as king of Spain, made William stadtholder of the Dutch provinces of Holland, Zeeland, and Utrecht. The same year William succeeded his father as count of Nassau.

Under Philip, Spanish imperial rule in the Netherlands was harsh and intolerant, especially toward Protestants, who were persecuted by the Inquisition (q.v.). William and other members of the Dutch nobility organized a strong move-



William I, Prince of Orange
Bettmann Archive

ment against Spanish oppression, with the result that in 1564 Philip was forced to recall the hated Netherlands prime minister, Cardinal Antoine Perrenot de Granvelle (1517–86). Three years later, however, Philip, alarmed by a widespread Dutch rebellion, sent Fernando Álvarez de Toledo, Duke of Alva (q.v.), and an army to the Netherlands with instructions to stamp out all civil and religious dissent. William was forced to flee to Germany. Alva ordered William to appear before the inquisitorial council and, when William ignored the order, seized his Dutch properties. William assembled an invasion army and in 1568 he entered the Netherlands, where he was soon defeated because the Dutch failed to support him. The rebellion gradually grew stronger, however, and in 1572 the northern Dutch provinces of Holland and Zeeland revolted successfully against the Spanish and elected William, who had become a Calvinist, as their stadtholder. After several more years of bitter fighting, sixteen of the seventeen prov-

inces united against Spain under the terms of the so-called Pacification of Ghent, signed on Nov. 8, 1576. Powerful imperial forces soon reconquered the five southern provinces that constitute present-day Belgium, but in 1579 the northern provinces, with William as leader, formed the Union of Utrecht; see NETHERLANDS, THE: *History: The Struggle for Independence*. A few years later, William was killed by an assassin. He was succeeded as stadtholder by his son Maurice of Nassau (1567–1625).

William was one of the great patriots of Dutch history. He gave his fortune and his life to the cause of Dutch independence and religious freedom. Although he was unable to unite all of the Netherlands provinces, the Union of Utrecht became the nucleus of the present Dutch nation.

WILLIAM AND MARY, COLLEGE OF, coeducational State-controlled institution of higher learning, located in Williamsburg, Va., with junior-college affiliates at Newport News, Va., and

Petersburg, Va. Established by a charter granted in 1693 by King William III and Queen Mary II (qq.v.) of England to the Reverend James Blair (1655–1743), the College of William and Mary is the second-oldest college in the United States, preceded only by Harvard College. Blair became the first president of William and Mary and held that post for fifty years. The college was closed for a short time in 1781, during the American Revolution. It was again closed from 1861 to 1865 during the Civil War, when the entire faculty and about 90 percent of the student body enlisted in the army of the Confederacy; and once again from 1881 to 1888, when lack of funds forced suspension of instruction. The college was placed under State control in 1906 and became a coeducational institution in 1918. Phi Beta Kappa (q.v.) was founded at William and Mary in 1776, and the college was the first to offer elective courses and to use the honor system.

The College of William and Mary is a liberal arts and sciences college with preprofessional programs in the fields of medicine, dentistry, engineering, medical technology, public health service, veterinary medicine, and forestry, and professional programs in law, business administration, teaching, and marine biology, the latter comprising a doctoral program. The Marshall-Wythe School of Law, originally established in 1779, is the oldest law school in the U.S. William and Mary confers the degrees of bachelor and master and maintains a summer session and evening college. In addition, it offers extension courses throughout the eastern part of Virginia. **Famous Alumni.** From the college were graduated Presidents of the United States Thomas Jefferson, James Monroe, and John Tyler and the first Chief Justice of the United States, John Marshall (qq.v.). President George Washington (q.v.) was college chancellor from 1788 to his death. The original college building, called the Sir Christopher Wren House in honor of its reputed architect (see WREN, SIR CHRISTOPHER), still stands. It is the oldest academic building in the U.S. This and other early structures of the college have been restored to approximately their original appearance through the generosity of the American philanthropist John Davison Rockefeller, Jr. (see under ROCKEFELLER).

The college library contains more than 349,000 bound volumes; in addition, it has an extensive collection of manuscripts, rare books, family papers, and portraiture representing Virginia history through three centuries. In 1968 enrollment at the College of William and Mary totaled 7246 students, the faculty numbered 478,

and the endowment of the college was about \$3,960,000.

WILLIAM OF ORANGE. See WILLIAM I, Prince of Orange; WILLIAM III, King of England.

WILLIAM OF WYKEHAM. See WYKEHAM, WILLIAM OF.

WILLIAM OF NEWBURGH (1136?–98?), English monk and chronicler. He was brought up, lived, and died at the Augustinian priory of Newburgh (in present-day North Riding, Yorkshire). He is the author of *Historia Rerum Anglicarum* ("History of English Affairs"), written from about 1196 to about 1198. It covers the period from 1066 to 1198, especially the reigns of the English kings Stephen and Henry II (qq.v.). As a historical work, it is valuable chiefly because of William's keen insight into the men and events of his day.

WILLIAM THE LION (1143–1214), King of Scotland (1165–1214). He was a grandson of King David I (q.v.), and the brother of Malcolm IV (1141–65), whom he succeeded. After a quarrel with Henry II (q.v.), King of England, William concluded an alliance between Scotland and France in 1168. In 1173, with Louis VII (q.v.), King of France, he aided Henry's sons in their unsuccessful rebellion against their father. William invaded Northumberland, and the next year, while raiding the countryside near Alnwick, he was captured by the English, who took him to Normandy. He was able to obtain his freedom only by assenting to the Treaty of Falaise, which acknowledged Henry as overlord of Scotland. In 1188 William secured a papal bull guaranteeing the independence of the Scottish church from that of England, and in 1189 Richard I (q.v.), King of England, annulled the Treaty of Falaise, surrendering all claims to suzerainty over Scotland in return for a large payment. William was succeeded by his son Alexander II (see under ALEXANDER).

WILLIAMS, name of two American brothers, prominent as scientists.

Robert R. Williams (1886–1965), chemist, born in Nellore, India, and educated at the University of Chicago. From 1908 to 1915 he served as a chemist at the Bureau of Science in the Philippines, and from 1915 to 1918 he worked at the Bureau of Chemistry, Washington, D.C. Subsequently Williams was a chemist with the Western Electric Company and the Bell Telephone Laboratories and director of grants for the Research Corporation in New York City. In 1933 he succeeded in isolating vitamin B₁, called thiamine, from a solution of rice polishings, and in 1936 he synthesized the vitamin. He was a coauthor of *Vitamin B₁ and Its Use in Medicine*

WILLIAMS, SIR GEORGE

(1938) and the author of *Toward Conquest of Beriberi* (1961).

Roger John Williams (1893–), biochemist, born in Ootacamund, India, and educated at the universities of Redlands and Chicago. He taught chemistry at the University of Oregon from 1920 to 1932, and at Oregon State College from 1932 to 1939, when he became professor of chemistry at the University of Texas. From 1941 to 1963 he served as director of the Clayton Foundation Biochemical Institute at the University of Texas. Williams is best known for his discovery of pantothenic acid, a member of the vitamin-B complex that is associated with neurological disorders. He also conducted important researches in the biochemistry of alcoholism (q.v.). In 1957 he was elected president of the American Chemical Society. Among his writings are *Nutrition and Alcoholism* (1951) and *Biochemical Individuality* (1956).

WILLIAMS, Sir George (1821–1905), British merchant and founder of the Young Men's Christian Association (q.v.), born in Dulverton, Somersetshire, England. In 1841 he was employed by a London drygoods firm, in which he

later became a partner. He began to hold prayer meetings with a group of fellow employees, and in 1844 he founded the Young Men's Christian Association, a society intended to improve "the spiritual condition of Young men engaged in the drapery and other trades". Under Williams' leadership the movement spread rapidly throughout England, and was extended to other countries, including Canada and the United States. He was treasurer of the British Y.M.C.A. from 1863 to 1895, when he became its president.

WILLIAMS, Ralph Vaughan. See VAUGHAN WILLIAMS, RALPH.

WILLIAMS, Roger (1603?–83?), English Puritan clergyman and founder of the American colony of Rhode Island, born in London, and educated at the University of Cambridge. During his residence at Cambridge, the university was a center of religious controversy. He became an advocate of the Calvinist theology, and he was a member of the party that opposed the ecclesiastical organization of the established Church; see CALVINISM; CHURCH OF ENGLAND. Upon taking clerical orders he served as chaplain to a Puritan (see PURITANS) household in Essex, and his association there with the Puritan leaders Oliver

Roger Williams lands on the shore of Narragansett Bay in 1636.
American Museum of Photography



Cromwell (see under CROMWELL), John Winthrop (see under WINTHROP), and Thomas Hooker (q.v.) led to his complete separation from the Anglican Church.

Shortly after the founding of the Massachusetts Bay Colony in the New World by Winthrop and others, Williams emigrated to New England, arriving in Boston in February, 1631. He rejected an invitation to serve as temporary pastor of the Boston congregation because that church had not officially severed ties with the Church of England. He then obtained an appointment as teacher of the church in Salem, Mass., but following a disagreement with the Boston authorities concerning the regulation of religious matters, he went to Plymouth Colony as assistant pastor. In 1633 he was permitted to return to Salem as an assistant teacher, and in 1634 he was appointed teacher. Williams again found himself in conflict with the colonial government when he challenged the validity of the Massachusetts Bay charter, which gave the authorities power to appropriate Indian lands without compensation and to establish a uniform faith and worship among the colonists. He asserted that only direct purchase from the Indians constituted a valid title to land, and he denied the right of the government to punish what were considered religious infractions. In October, 1635, the Massachusetts general court issued an order banishing Williams from the colony, and in January, 1636, he escaped deportation by the authorities and began a journey to Narragansett Bay.

Religious Toleration. Williams became friendly with the Narragansett Indians (q.v.), making a study of their language. In 1636 he purchased lands from the tribe. Together with a few companions he established the settlement of Providence and the colony of Rhode Island, naming the settlement in gratitude "for God's merciful providence unto me in my distress". The government of the colony was based upon complete religious toleration and upon separation of church and state. Each household exercised a voice in the conduct of government and received an equal share in the distribution of land. Accepting the practice of adult baptism (q.v.) by immersion, Williams was baptized by a layman in 1639; he subsequently baptized a small group and thus founded the first Baptist (q.v.) church in America. Later in the same year he withdrew from the church he had founded, and declared himself to be a "seeker", that is, one who accepts the fundamental beliefs of Christianity but does not profess a particular creed.

The Providence Plantations. Williams went to England in 1643, and obtained a colonial charter incorporating the settlements of Providence, Newport, Plymouth, and Warwick as "The Providence Plantations in Narragansett Bay". During his sojourn abroad he wrote *A Key into the Language of America* (1643) and *The Bloudy Tenent of Persecution* (1644), the latter treatise being a notable work on the nature and jurisdiction of civil government. He also wrote the tract *Christenings Make Not Christians* (1645).

Upon returning to Rhode Island Williams found that leadership of the colony had been assumed by the opponents of his democratic system, and in 1651 he returned to England in order to confirm the rights granted by the charter. During this visit he became a friend of the English poet John Milton (q.v.). Williams returned to Rhode Island in 1654, and was elected president of the colony, serving until 1657. Because of his policy of complete religious toleration, the colony was a haven for refugees from bigotry. Notable among these were Quakers (see FRIENDS, SOCIETY OF) forced by persecution to leave the Boston area. Williams became involved, however, in a controversy with the Quakers, the substance of which is contained in his work *George Fox Digg'd Out of His Burrowes* (1676). When the Narragansett tribe joined the Indian revolt of 1675, known as King Philip's War (see PHILIP), Williams served as a captain of forces defending Providence. Thereafter, he participated in the political life of the colony until the time of his death. He is chiefly remembered as one of the notable champions of democracy and religious freedom in the American colonies.

WILLIAMS, Ted, in full THEODORE SAMUEL WILLIAMS (1918–), American baseball player and manager, born in San Diego, Calif. He began his career in professional baseball in 1935 with the minor-league Padres team of San Diego, Calif. In 1937 he joined the Boston (Mass.) Red Sox of the American League and four years later batted .406 becoming the most recent player since 1911 to have a season's average of at least .400. With the exception of two periods of service as a pilot in the United States Marine Corps, during World War II and the Korean War, Williams remained with the Red Sox as an outfielder until his retirement in 1960. During his major-league career Williams earned a lifetime batting average of .344, batted in 1839 runs, hit 521 home runs, and was batting champion of the American League six times. In 1966 he was elected to the Baseball Hall of Fame; see BASEBALL HALL OF FAME AND MUSEUM, NATIONAL.



Ted Williams in 1939

Wide World

Williams returned to baseball in 1968 as manager of the Washington (D C) Senators (now Texas Rangers), and in his debut was chosen league manager of the year. In 1969 the Baseball Writers' Association of America named Williams one of the three greatest living outfielders. He retired as manager in 1972.

WILLIAMS, Tennessee (1911-), American playwright, regarded as one of the foremost dramatists of the 20th century

He was born Thomas Lanier Williams in Columbus, Miss., on March 26, 1911, and spent most of his youth in Saint Louis, Mo. After intermittent attendance at the University of Missouri and Washington University (St. Louis), he received a B A degree from the University of Iowa in 1938. He worked at a wide variety of odd jobs until 1945, when he first appeared on the Broadway scene as the author of *The Glass Menagerie*. This evocative "memory play" won the New York Drama Critics' Circle award as the best play of the season. It was filmed (1950) and has been performed throughout the world. The emotion-charged *A Streetcar Named Desire* (1947) has been called the best play ever written by an American. It was successfully filmed (1952), and it won Williams his first Pulitzer Prize in drama. He was awarded another Pulitzer for *Cat on a Hot Tin Roof* (stage, 1954; film, 1958). All three of these plays contain the poetic dialogue, the

symbolism, and the highly original characters for which Williams is noted, and are set in the American South, a setting which the author used to create a remarkable blend of decadence, nostalgia, and sensuality. Other successful plays by Williams are *Summer and Smoke* (1948), rewritten as *Eccentricities of a Nightingale* (produced 1964); *The Rose Tattoo* (1950), the long one-act *Suddenly Last Summer* (1958), *Sweet Bird of Youth* (1959), and *Night of the Iguana* (1961). Although Williams continued to write for the theater in the 1960's and 1970's, he was unable to repeat the critical and financial success of most of his early works.

Two collections of his many one-act plays were published: *27 Wagons Full of Cotton* (1946) and *American Blues* (1948). Williams' fiction includes two novels—*The Roman Spring of Mrs. Stone* (1950) and *Moise and the World of Reason* (1975)—and four volumes of short stories—*One Arm and Other Stories* (1948), *Hard Candy* (1954), *The Knightly Quest* (1969), and *Eight Mortal Ladies Possessed* (1974). Nine of his plays were made into films, and he wrote one original screenplay, *Baby Doll* (1956). In his provocative *Memoirs* (1975), the playwright describes his own dramatic problems with drugs, alcohol, physical and mental disability, and his latterly avowed homosexuality.



Tennessee Williams

Wide World

WILLIAMS, William Carlos (1883–1963), American poet, novelist, and physician, born in Rutherford, N.J., and educated at the University of Pennsylvania and the University of Leipzig, Germany. After 1910 he practiced medicine in Rutherford. At the same time he carried on his literary work, and his reputation, first as a poet and later as a writer of prose, became worldwide. Williams' early verse, collected in *Poems* (1909) and *The Tempers* (1913), was written under the influence of the literary movement known as imagism (q.v.). His mature work, often radically experimental in technique and form, is characterized by reliance upon the language of common speech, emotional restraint, and a concentration on concrete, sensory experience. Examples of his later poetry are contained in *Complete Collected Poems* (1938), and *Collected Later Poems* (1950). In the late 1930's Williams began the composition of an extended poem dealing with the American scene, *Pater-son, Books I–V* (1946–58). His prose works include a widely read collection of essays on American history, *In the American Grain* (1925), and the novels *White Mule* (1937), *In the Money* (1940), and *Build-up* (1952). In 1950 Williams received the National Book Award for poetry, and

in 1963 he was awarded the Pulitzer Prize for his collection of verse *Pictures from Breughel* (1962). His novel, *A Voyage to Pagany*, was published posthumously in 1970.

WILLIAMSBURG, independent city of Virginia, in James City and York counties, and county seat of James City Co., on the peninsula between the York and James rivers, about 45 miles s.e. of Richmond. Because of its historic associations and the authenticity and charm of its many colonial buildings, the city is a major tourist center. Williamsburg and neighboring James City County lie in an agricultural and lumbering area and contain industrial establishments manufacturing synthetic fibers, beer, and pottery. The College of William and Mary (q.v.) is located in the city and Eastern State Hospital, established in 1770 and one of the oldest State-supported mental institutions in the United States, is nearby in James City Co.

Colonial Restoration. Beginning in 1927, a section of the city was restored along colonial lines, and financed by the American philanthropist John Davison Rockefeller, Jr. (see under ROCKEFELLER). The historic area of Williamsburg covers 170 acres within the heart of the modern city of Williamsburg. Within this area are

Part of the fascination of colonial Williamsburg lies in the routines of Early American occupations and trades. At the Raleigh Tavern Bake Shop a master baker and his apprentice bake fresh bread and sweetmeats daily. Authentic 18th-century utensils are used to grind the flour and slide it into the wood-fire brick oven.

Colonial Williamsburg
Photograph



WILLIAMSBURG

eighty-five 18th-century buildings that have been restored to their original appearances. To recreate the colonial city, another fifty major buildings and several hundred smaller structures have been rebuilt on original sites after extensive archeological, architectural, and historical research. Set in acres of public gardens and greens and on the Duke of Gloucester Street and adjacent streets are eleven principal exhibition areas: The Capitol, first completed in 1705, where the American Revolutionary orator and patriot Patrick Henry (q.v.) delivered his famous "Caesar-Brutus" speech, and where the Virginia legislature still meets once every four years; the Governor's Palace, completed in 1720; the Peyton Randolph House (1715 with later additions); the James Gaddy House (1750) and Silversmith Shop; Wetherburn's Tavern (1738 with later additions); the Raleigh Tavern, built prior to 1742; the Wren Building of the College of William and Mary (1695); the Public Gaol (1701); the Magazine (1715), where the arms and ammunitions of the colonists were stored; the George Wythe House (about 1754), home of the first professor of law in an American college and headquarters for General George Washington (q.v.) prior to the siege of Yorktown; and the Brush-Everard House (1717). These eleven areas encompass more than forty buildings with more than 200 rooms furnished primarily with American and English antiques. Costumed hosts, hostesses, gaolers, guardsmen and other interpreters impart the history of these buildings and interesting facts about their colonial inhabitants during frequent tours that originate at each major building. Other buildings of primary interest are Bruton Parish Church (1715), said to be the oldest Episcopal church in continuous use in the U.S.; the Courthouse of 1770, now maintained as an archeological museum; and the Brafferton Building (1723) and President's House (1732), both on the college campus. There are also seventeen small craft shops including those of the bootmaker, cabinetmaker, gunsmith, clockmaker, and wigmaker, where the 18th-century trades are demonstrated.

History. Williamsburg was settled in 1632 as Middle Plantation. Because of the superiority of its location to Jamestown (q.v.), the first capital of the Virginia colony, Middle Plantation was made the capital in 1699 and later renamed Williamsburg in honor of William III (q.v.), King of Great Britain. It was incorporated as a city in 1722. One of the leading social and cultural centers of all colonial America, Williamsburg served as the colonial and State capital of Virginia from 1699 until 1779, when the seat of

government was transferred to Richmond. During the Civil War, the city was captured by Union forces under General George Brinton McClellan (q.v.) on May 5, 1862; see CIVIL WAR, THE AMERICAN. Pop. (1960) 6832; (1970) 9069.

WILLIAMS COLLEGE, privately controlled college of liberal arts for men, located in Williamstown, Mass. The college was incorporated as the Free School in 1785, in accordance with a bequest made in the will of the American French and Indian War officer Ephraim Williams (1714–55). The Free School was opened in 1791 and chartered as a college under the present name two years later. The degrees of bachelor and master are conferred. The college library, containing about 290,000 bound volumes, includes several noted collections, among them the Chapin Library of rare books. Undergraduate enrollment in 1968 totaled 1311 students; the faculty numbered 160. The endowment of the institution was about \$43,567,000.

WILLIAM SMITH COLLEGE. See HOBART AND WILLIAM SMITH COLLEGES.

WILLIAMSPORT, city in Pennsylvania, and county seat of Lycoming Co., on the w. branch of the Susquehanna R., 75 miles s.w. of Scranton. It is an industrial center producing widely diversified manufactures, including glass and stone products, food products, leather and rubber goods, lumber products, metal goods, mining and quarrying products, paper materials, and textiles. Lycoming College (1812), Dickinson Junior College, and Williamsport Technical Institute are in the city. Williamsport is the national headquarters of Little League baseball, which originated there in 1939; see BASEBALL: *Boys Baseball*. Settled in 1756, Williamsport was incorporated as a borough in 1806 and as a city in 1866. Pop. (1960) 41,967; (1970) 37,918.

WILLIBRORD, Saint or **WILBRORD, Saint** or **WILBROD, Saint** (about 658–739), called the Apostle of the Frisians, born in the kingdom of Northumbria (q.v.). He was educated at the monastery of Ripon under Saint Wilfrid (q.v.) and became a Benedictine monk; see BENEDICTINES. Willibrord went to Rathmelsigni, a monastery whose site is no longer known, in Ireland, in 678 and remained for twelve years under the tutelage of Saint Egbert of Iona (639?–729), who ordained him in 688. About 690 Egbert sent him to Friesland (now part of the Netherlands) as a missionary. Willibrord won the protection of the Frankish ruler Pepin of Herstal (see under PEPIN), who had recently conquered the country. In 692 Willibrord went to Rome and returned to his mission with the sanction of Pope Sergius I (see under SERGIUS); during a second visit to

Rome (about 695) he was made an archbishop. Establishing his see at Trajectum (now Utrecht), which became a center of Christian culture, he spent over forty years in missionary endeavors and completely converted Friesland to Christianity. His work in Utrecht was interrupted by the brief ascendancy of Rathbod, King of Friesland (fl. 8th cent.), who from 716 to 719 held the country and attempted to restore pagan worship. During that period Willibrord made one of the earliest attempts to convert the Danes. Willibrord died at a monastery he had founded in Echternach (now in Luxembourg). He was canonized shortly afterward. The English missionary and primate Saint Boniface (q.v.) continued his work. The English chroniclers Bede and Alcuin (qq.v.) wrote an account of Willibrord's life.

WILLIMANTIC, city in Connecticut, and a county seat of Windham Co., near the Willimantic Reservoir, about 23 miles E. of Hartford. Known as the Thread City, Willimantic also manufactures yarn, machinery, electrical equipment, and hardware. It is the site of Eastern Connecticut State College, founded in 1889. Willimantic was incorporated in 1893. Pop. (1960) 13,881; (1970) 14,402.

WILLINGBORO, township of New Jersey, in Burlington Co., on Rancocas Creek, in the Delaware R. valley, midway (18 mi.) between Trenton and Camden. In 1950 the area was rural, with a population of 852. In 1958 Levitt & Sons developed a planned community here, and in the following year the name was changed to Levittown; in 1963 the name Willingboro was restored. Pop. (1960) 11,861; (1970) 43,414.

WILLINGDON, 1st Marquis of, Freeman Freeman-Thomas (1866–1941), British statesman and colonial administrator, born in Ratton, Sussex, England, and educated at Eton and Trinity College, Cambridge. He was a Liberal member of Parliament from 1900 until 1910, when he was made Baron Willingdon of Ratton. From 1913 to 1924 he served in India, governing first Bombay (1913–19) and then Madras. He was made a viscount in 1924, headed the Indian delegation at the Assembly of the League of Nations (q.v.) in Geneva in 1925, and from 1926 to 1931 served as governor-general of Canada. Created 1st earl of Willingdon and sent to India as viceroy in 1931, he was a prime mover in the difficult negotiations that led to the Government of India Act of 1935 and in the setting up afterward of the new Indian administrative machinery. He became a marquis in 1936. *See also* INDIA: *History: Increasing Internal Dissension*.

WILLIS, Nathaniel Parker (1806–67), American journalist, born in Portland, Me., and educated

at Yale College (now Yale University). In 1827 a collection of his poetry was published, and in 1829 he established the *American Monthly Magazine* in Boston, Mass. Subsequently he was employed as a foreign correspondent by the American journalist George Pope Morris (q.v.), editor of the *New York Mirror*. Between 1831 and 1836 Willis traveled in Europe, and he supplied the *Mirror* with popular essays that described the life of European society and reported on distinguished literary and political figures. He became the editor of a weekly magazine, *The Corsair*, that published contributions by the British novelist William Makepeace Thackeray (q.v.). In 1840 Willis and Morris collaborated in the publication of the *New Mirror*, and in 1845 the two journalists became mutual editors of the *Home Journal*. Willis' writings comprised fiction, drama, several volumes of poetry, and numerous collections of essays, including *People I Have Met* (1850), and *Famous Persons and Places* (1854).

WILLISTON, city in North Dakota, and county seat of Williams Co., on the Missouri R., near the Montana State line, about 120 miles W. of Minot. A marketing and distribution center of spring wheat and livestock, the city also has some manufacturing. There is an oil refinery, as well as dairy-processing plants in the area. An agricultural experiment station is here. Williston was settled about 1880, and incorporated as a city in 1904. Pop. (1960) 11,866; (1970) 11,280.

WILLKIE, Wendell Lewis (1892–1944), American lawyer and politician, born in Elwood, Ind., and educated at Indiana University. He began the practice of law in Indiana in 1916. During World War I he served overseas in the United States Army and attained the rank of captain. He joined a law firm in Akron, Ohio, after the war. In 1933, following several years as an attorney in New York City, he became president of the Commonwealth and Southern Corporation, a utility holding company. In this capacity Willkie led the struggle of the private utility companies against the development of the Tennessee Valley Authority (q.v.), a Federal power project initiated by President Franklin Delano Roosevelt (q.v.). In 1940 he was nominated by the Republican Party (q.v.) to run for the Presidency against Roosevelt, who was then seeking a third term. Willkie's running mate, the Republican Vice-Presidential candidate, was Charles Linza McNary (1874–1944), United States Senator from Oregon and Senate minority leader after 1932. Despite a vigorous campaign and a popular vote of 22,321,018, Willkie was defeated. After the entry of the United States into World War II in December, 1941, Willkie declared his total sup-



Weeping willow, *Salix babylonica* U.S. Dept. of Agriculture

port of the President, and for the remainder of his life was an influential spokesman for Roosevelt's war policies. In support of the national war effort he traveled abroad in 1942 as Roosevelt's semiofficial envoy, visiting China, the Soviet Union, and other Allied nations. He described his experiences and outlined his views on world peace in *One World* (1943), a work that received critical acclaim and wide circulation.

WILLMAR, city in Minnesota, and county seat of Kandiyohi Co., about 53 miles s.w. of Saint Cloud. The city has varied manufacturing. Willmar is a dairy and farm region, and poultry is processed. It is the site of Willmar State Junior College, established in 1961. Willmar was settled in 1856, and incorporated as a city in 1901. Pop. (1960) 10,417; (1970) 12,869.

WILLOUGHBY, city of Ohio, in Lake Co., near Lake Erie, on the Chagrin R., about 19 miles n.e. of Cleveland. Manufactures include furniture, metal products, chemicals, and machinery. Willoughby was settled about 1800, and incorporated as a city in 1853. Pop. (1970) 18,634.

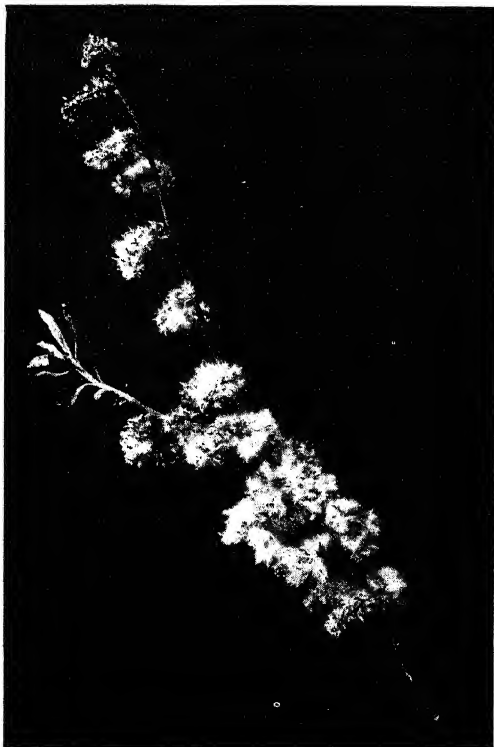
WILLOW, common name applied to a family of perennial trees and shrubs, Salicaceae and to its principal genus, *Salix*, and to any plant of the genus. The genus contains numerous species and natural hybrids, that are most abundant in the Northern Hemisphere in temperate climate. Those species occurring in the Arctic Regions are low shrubs; others are of considerable size and remarkably rapid growth. Willow stakes driven into moist soil strike root, and soon become luxuriant. The male and female flowers,

which are borne on separate trees, are arranged in catkins. The fruit is a dehiscent, many-seeded pod, and the leaves are simple, alternate, and elongated.

Willows are widely cultivated as ornamental trees. Because of their extensive root system, the trees are valuable as soil binders, and are planted on the banks of rivers and lakes to prevent erosion. The wood is light in weight, tough, and durable, and is used extensively for caskets, artificial limbs, and other special purposes. The slender, flexible twigs of various species known as osiers are used in weaving baskets.

The black willow, *S. nigra*, is native to eastern North America and is found along the banks of streams. It has dark-brown bark and sometimes grows to a height of 60 ft. The white willow, *S. alba*, is a European species, which has become naturalized in the United States. It is a large tree, frequently 70 ft. tall, with yellowish-brown branches. The osier willow, *S. siminalis*, is native to Europe and Asia; it attains a height of 20 ft., and bears golden-yellow catkins. The weeping willow, *S. babylonica*, a popular ornamental tree which is native to China, has graceful, drooping branches. Another well-known species, native

Ripe willow catkins carry seeds bearing fine tufts of hair. U.S. Forest Service



to North America, is the shrublike pussy willow, *S. discolor*, which bears furry catkins in the spring. The gray willow, *S. humilis*, is an American gray-branched shrub about 2 ft. in height.

WILLOWICK, city of Ohio, in Lake Co., on Lake Erie, about 16 miles N.E. of central Cleveland. The city, primarily residential, was incorporated in 1924. Pop. (1970) 21,237.

WILLS, Helen Newington (1906–), American tennis champion, born in Centerville (now part of Fremont), Calif., and educated at the University of California. She is generally considered the greatest woman player in the history of tennis. She was United States women's singles champion from 1923 to 1925, and again from 1925 to 1929, winning her final U.S. title in 1931. She was also a member of the championship women's doubles team in 1922 and in 1924–25. Helen Wills was Wimbledon women's singles champion from 1927 to 1930, in 1932–33, 1935, and 1938. She also won four French titles before retiring from active competition in 1938. In 1959 she was elected to the United States Lawn Tennis Hall of Fame. (After 1929 she played as Helen Wills Moody, using her first husband's name; her second husband's name was Roark.)

WILLSTÄTTER, Richard (1872–1942), German organic chemist, born in Karlsruhe, and educated at the University of Munich. In 1905 he became professor at the Technische Hochschule in Zürich, Switzerland. He was director of the Kaiser Wilhelm Institute in Berlin from 1912 to 1916, when he was appointed professor at the University of Munich. The university adopted anti-Semitic policies during his tenure, and in protest he resigned his position in 1925. He subsequently returned to Zürich, where he worked privately until his death.

Willstätter is considered the outstanding researcher of his time in the field of organic chemistry. He specialized in the investigation of complex organic compounds, notably chlorophyll (q.v.) and other plant pigments. He also conducted research on enzymes (q.v.) and on the fermentation process. His other achievements include the synthesis of the alkaloid cocaine. He was awarded the 1915 Nobel Prize in chemistry for his work on plant pigments.

WILMETTE, village of Illinois, in Cook Co., 14 miles N. of Chicago, of which it is a residential suburb. The village is the American headquarters of the Bahai faith and the site of the Bahai Temple (1921); see **BAHAI**. Wilmette was incorporated in 1872. Pop. (1970) 32,134.

WILMINGTON, city and port of entry in Delaware, and county seat of New Castle Co., at the confluence of the Delaware and Christina rivers,

26 miles S.W. of Philadelphia. The largest city in population in the State, it is also the leading commercial and manufacturing center and an episcopal see of the Protestant Episcopal and Roman Catholic churches. Wilmington is connected with New Jersey by the Delaware Memorial Bridge (1951). The port has about 5 mi. of waterfront and a municipal marine terminal.

In and near Wilmington are the executive offices, research laboratories, and various plants of the E.I. du Pont de Nemours & Co., Inc. (founded in 1802), largest chemical and explosives manufacturing company in the world. The city has large railroad shops and shipyards; other important industries are oil refining, automobile assembling, and the manufacture of iron and steel, leather, hard fiber, braided rubber and plastic hose, and cotton textiles.

Wilmington has more than 785 acres of parks. Points of interest include Holy Trinity (Old Swedes) Church, built in 1698 and still in use; the First Presbyterian Meeting House (1740), now occupied by the Historical Society of Delaware; the Old Town Hall (1798); the Wilmington Art Center, containing an excellent collection of paintings by American and European artists; the Cathedral church of Saint John (Protestant Episcopal), built in 1857, in which hangs a painting by the Italian painter Titian (q.v.); the statue before the du Pont building commemorating Caesar Rodney (q.v.), who rode to Philadelphia in July, 1776, to sign the Declaration of Independence; and the site, now a State park, of Fort Christina (1638).

History. Wilmington was settled in 1638 by a group of Swedish and Dutch colonists, led by the Dutch colonial governor Peter Minuit (q.v.), who called their settlement Christinaham in honor of Christina, Queen of Sweden (1626–89). In 1655 Dutch forces led by Peter Stuyvesant (q.v.), governor of New Netherland (now New York), captured Fort Christina and took control of the settlement. It passed to English control in 1664. In 1739 the settlement, then known as Willingtown, received its present name and became a borough under a charter granted by the founder of Pennsylvania, William Penn (q.v.). In 1777, during the American Revolution (q.v.), the British captured Wilmington and held it for a brief period. Wilmington was chartered as a city in 1832. The first iron steamship built in the United States was constructed in the city in 1836. Before the American Civil War Wilmington was an important station on the so-called underground railroad (q.v.), by which escaping Negro slaves were helped to freedom. Pop. (1960) 95,827; (1970) 80,386.

WILMINGTON

WILMINGTON, city and port of entry in North Carolina, and county seat of New Hanover Co., on the Cape Fear R., 30 mi. above its mouth, and 115 miles s.e. of Raleigh. The principal distributing point for North Carolina and parts of South Carolina and Georgia, it has excellent harbor facilities, and ranks among the leading ports of the Atlantic coast in the volume of fertilizer and petroleum products handled. Industrial establishments include shipyards, oil refineries, lumber mills, and plants producing fertilizers, chemicals, and textiles. Wilmington is also a leading resort center with several lakes and ocean-bathing beaches in the vicinity. Among the points of interest are the American Revolution headquarters of the British commander in chief Charles Cornwallis (q.v.); Greenfield Lake and gardens, notable for azaleas and roses; Saint James Episcopal Church, dating from 1740; Wilmington National Cemetery, established in 1867; the New Hanover County Historical Museum; and Wilmington College, a junior college founded in 1947.

A settlement known as New Liverpool was established on the site of the present-day city in 1730. It was renamed Wilmington, and was incorporated as a town in 1739. Wilmington was the center of violent resistance to the Stamp Act (q.v.), an act passed by the British Parliament in 1765 to raise revenue in the American colonies. The town was captured by the British in 1780 and served in 1781 as the headquarters of Cornwallis. During the Civil War Wilmington was the chief port of the Confederacy and was kept open by the South until the fall (1865) of Fort Fisher, a defense bastion near the mouth of the Cape Fear R.; see CIVIL WAR, THE AMERICAN. The city was incorporated in 1866. Pop. (1960) 44,013; (1970) 46,169.

WILMOT PROVISIO, amendment attached to an appropriations bill adopted in 1846 by the United States House of Representatives, proposed by David Wilmot (1814–68), a Democratic Representative from Pennsylvania. At the conclusion of the Mexican War (q.v.), President James Knox Polk (q.v.) requested from Congress the sum of \$2,000,000, in order to indemnify the Mexican government for territory annexed by the United States. The Wilmot Proviso moved to exclude slavery (q.v.) from the acquired territory and was approved by the House on Aug. 8, 1846. The United States Senate adjourned without considering the measure and, following a second approval by the House on Feb. 1, 1847, the bill was rewritten by the Senate to exclude the amendment. Because it brought into sharp focus the differences then existing on the

slavery question, the proviso was the subject of widespread controversy that resulted in increased hostility between the Northern and Southern States. The principle of the amendment became the basic policy of both the Free-Soil party and the Republican Party (qq.v.).

WILNA, Elijah or WILNA, Elias, known also as ELIJAH BEN SOLOMON or ELIJAH BEN SOLOMON ZALMAN (1720–97), Lithuanian scholar of the Cabala and Talmud (qq.v.), born in Vilna (now in the Lithuanian S.S.R.). Reputedly a precocious child, he was largely self-educated. Called the Gaon (Heb., “majesty”, an honorific) of Vilna, Elijah was one of the first authoritative critics of rabbinical texts, although he refused to act as a rabbi (q.v.) in his own community. At the time, overattention to detail in rabbinical studies had led to the opposing development of Hasidism (q.v.) by the Baal Shem-Tob (q.v.) and the beginnings of the so-called Jewish enlightenment (later called the Haskalah) in western Europe; see JEWS: *Jews in Modern Life*. Elijah prepared commentaries on the Talmud and on Hebrew classics and encouraged the study of the sciences as an essential adjunct to the study of Judaism (q.v.). He wrote a Hebrew grammar and treatises on mathematics and astronomy. But he rejected contemporary tendencies toward cultural assimilation, and he denounced what he considered the pantheism (q.v.) of the Hasidim as well.

See BIBLE, INTERPRETATIONS OF THE.

WILNO. See VILNYUS.

WILSON, city in North Carolina, and county seat of Wilson County, about 48 miles e. of Raleigh. It has tobacco markets and manufactures cotton, cotton-seed oil, foundry products, wagons, cigars, and harnesses. Atlantic Christian College (coeducational, founded in 1902) is here. It was incorporated in 1849. Pop. (1960) 28,753; (1970) 29,347.

WILSON, Alexander (1766–1813), American ornithologist and poet, born in Paisley, Scotland. In his boyhood he was apprenticed to a weaver. Possessing marked literary talent, he earned a meager livelihood as an itinerant poet and peddler of muslins. His narrative poem “Watty and Meg” was published anonymously in 1792, attaining great popularity, but was ascribed to the Scottish poet Robert Burns (q.v.). Subsequently, during a labor dispute in Paisley, Wilson wrote satiric verses lampooning the manufacturers. He was convicted of libel and imprisoned. Following his release in 1794, he emigrated to the United States.

While working as a village schoolmaster in Pennsylvania, Wilson became interested in or-

nithological research and began to collect material for a comprehensive work, illustrated with his own drawings, on the birds of America. From 1808 through 1813 he published seven volumes of his *American Ornithology*; an additional two volumes were edited and published posthumously. The first ornithologist to study American birds in their native habitats, Wilson is noted for the accuracy of his descriptions and for his superior illustrations. His work was supplemented in *American Ornithology, or History of Birds Inhabiting the United States Not Given by Wilson* (1825-33) by the French naturalist Charles Lucien Jules Laurent Bonaparte (1803-57). See also NATIONAL AUDUBON SOCIETY. **WILSON, Allen Benjamin.** See SEWING MACHINE: *History*.

WILSON, Charles Thomson Rees (1869-1959), British physicist, born in Glencorse, Scotland, and educated at Owens College (now Victoria University of Manchester) and the University of Cambridge. He remained at Cambridge after 1892 as lecturer, fellow, and demonstrator, and from 1925 to 1934 as professor of natural philosophy.

For his invention in 1912 of the cloud chamber (q.v.), a device used for photographic observation of the path of nuclear particles, Wilson shared the 1927 Nobel Prize in physics with the American physicist Arthur Holly Compton (see under COMPTON).

WILSON, Edmund (1895-1972), American author and critic, regarded by many as the foremost man of letters and mold of literary taste of his time in the United States. His writing covered an enormous range, including the novel, short story, drama, verse, history, biography, archeology, religion, and travel; but he was preeminently a social and literary critic.

Wilson was born on May 8, 1895, in Red Bank, N.J. Educated at Princeton University, he was a reporter for the *New York Evening Sun* in 1916-17. He was later an editor with *Vanity Fair* and the *New Republic* and book reviewer for *The New Yorker*. His lucid, elegant literary criticism was concerned with the social and psychological forces that influenced writers as well as with the literary aspects of their work. His books are often based on his reviews, which he wove together into continuous narratives. His first such work was *Axel's Castle* (1931), a critical examination of the symbolist influence on T. S. Eliot, James Joyce, and others. Another was *The Wound and the Bow* (1941), which dealt with the relationship between the emotional lives of writers and their work. Concerned with social problems, at the onset of the Great Depression

he wrote *The American Jitters: A Year of the Slump* (1932). For a while he was attracted by radical political movements; a product of this period was *To the Finland Station* (1940), a book about European revolutionaries. His *Memoirs of Hecate County* (1946), a collection of short stories, was banned for a time as obscene. *Patriotic Gore: Studies in the Literature of the Civil War* (1962) is considered one of his finest critical studies. His other works include the novel *I Thought of Daisy* (1929); *The Dead Sea Scrolls* (1955), an archeological report; and the autobiographical *Upstate: Records and Recollections of Northern New York* (1971). He died on June 12, 1972, at Talcottville, N.Y. A posthumous work, *The Twenties* (1975), was drawn from his notebooks and diaries.

WILSON, Harold, in full SIR JAMES HAROLD WILSON (1916-), British statesman, born on March 11, 1916, in Huddersfield, Yorkshire, and educated at Jesus College, University of Oxford. Wilson became a lecturer in economics at Oxford in 1937 at the age of twenty-one. During World War II, he left the university for service in several government departments. Wilson was elected to Parliament in 1945 as Labour Party member for Ormskirk, Lancashire. In 1947 he became a member of the Privy Council and president of the board of trade; he held the latter post until 1951.

In 1963 Wilson was elected leader of the Labour Party. In 1964, when his party gained a slim

Harold Wilson

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majority in Parliament, he became prime minister, remaining in office until the Conservatives won the general election of 1970. As prime minister, Wilson attempted, with limited results, to bolster Great Britain's weak economy by reducing overseas expenditures and by devaluing the pound sterling in 1967. Wilson also tried to mediate an end to the war in Vietnam (see VIETNAM, WAR IN) and to moderate the policies of the white-minority regime in Rhodesia (which unilaterally declared itself independent of Great Britain in 1965), but in each case he was unsuccessful.

Wilson again became prime minister in early 1974. Once more he had to deal with a deteriorating economy, notably an annual inflation rate that rose above 25 percent. Wilson retired unexpectedly as prime minister in April, 1976, partly to allow other Labour leaders to direct the government, but he retained his seat in Parliament. In mid-1976 he was knighted. See GREAT BRITAIN: *History*.

WILSON, Henry, originally JEREMIAH JONES COLBATH (1812–75), American political leader and eighteenth Vice-President of the United States, born in Farmington, N.H. He changed his name from Colbath to Wilson in 1833, after eleven years of service as an indentured farm laborer. Subsequently he learned shoemaking and in the late 1830's acquired ownership of a shoe factory in Natick, Mass. In 1840 he was elected to the Massachusetts legislature on the Whig Party (q.v.) ticket. He bolted the Whigs in 1848 to help found the antislavery Free-Soil Party (q.v.). The Free-Soil organization was dissolved in 1854, but the next year he won election to the United States Senate from Massachusetts, as a candidate of the Know-Nothings (q.v.). In the Senate Wilson gained national repute as a sincere and eloquent advocate of abolition; see ABOLITIONISTS. Still feeling the need for a strong, nationwide antislavery party, he broke with the Know-Nothings in 1855 and helped to organize the Republican Party (q.v.); see POLITICAL PARTIES IN THE UNITED STATES. He was reelected to the Senate from Massachusetts as a Republican in 1859. As chairman of the Committee on Military Affairs during the Civil War, Wilson played an important role in the recruiting, equipping, and training of Union forces. In 1873, after eighteen years of continuous service in the Senate, he became Vice-President under President Ulysses Simpson Grant (q.v.). He died in office after having been cleared of charges of corruption in connection with the political scandal involving the Cr dit Mobilier of America (q.v.).

WILSON, James (1742–98), American Revolutionary patriot and jurist, born near Saint Andrews, Scotland, and educated at the universities of St. Andrews, Glasgow, and Edinburgh. In 1765 he went to America. Settling in Philadelphia in 1766, he studied law and was admitted to the Pennsylvania bar the following year. In 1774 he published *Considerations on the Nature and Extent of the Legislative Authority of the British Parliament*, a pamphlet in which he maintained that Parliament was not legally empowered to make laws for the American colonies. The pamphlet greatly impressed the members of the Continental Congress (q.v.), to which he was elected in 1775. Wilson was one of the signers of the Declaration of Independence (q.v.). He served in Congress until 1777, again in 1782–83, and from 1785 until 1787. As a member of the Federal Constitutional Convention of 1787, he was a leading advocate of the principle, fundamental to democratic government, that sovereignty resides with the people; see CONSTITUTION OF THE UNITED STATES: *The Constitutional Convention*. In 1788 he was influential in securing ratification of the Constitution by Pennsylvania. He later helped draft the Pennsylvania State constitution. In 1790 he became the first professor of law at the College of Philadelphia, now the University of Pennsylvania. Appointed in 1789 an associate justice of the Supreme Court of the United States, he served in that capacity until his death.

WILSON, John, pen name CHRISTOPHER NORTH (1785–1854), British writer and educator, born in Paisley, Scotland, and educated at the universities of Glasgow and Oxford. He inherited a large fortune from his father at the age of twenty-one. Subsequently he purchased an estate on Windermere and there became an associate of the Lake Poets (q.v.). Wilson lost his fortune in 1815, and thereafter he resided in Edinburgh. In 1817 he joined the staff of *Blackwood's Edinburgh Magazine*. Under his pen name, he became one of its principal contributors and helped establish it as a highly influential review. A Tory (q.v.) in politics, he was in 1820 elected by the Tory-dominated town council to the chair of moral philosophy at the University of Edinburgh. He taught there for the next thirty years, meanwhile continuing his contributions to *Blackwood's*. Wilson's literary reputation rests chiefly upon *Noctes Ambrosianae*, a series of papers that appeared in *Blackwood's* between 1822 and 1835. These papers, most of which are credited to Wilson, are based on the conversations, largely imaginary, of a convivial group of friends who supposedly met at Am-

brose's Tavern in Edinburgh. Covering a broad range of literary, political, and social topics, Wilson's works are distinguished by vigor of expression, satirical wit, and extravagant sentiment. *Noctes Ambrosianae* was published separately in five volumes in 1866. See HOGG, JAMES.

WILSON, (Thomas) Woodrow (1856–1924), twenty-eighth President of the United States, born in Staunton, Va. The son of a Presbyterian theologian and minister, he was educated at the College of New Jersey (now Princeton University). After studying law at the University of Virginia, he practiced briefly in Atlanta, Ga., and earned a doctorate in history at Johns Hopkins University. In his thesis, published in 1885 as *Congressional Government*, he formulated a political philosophy notable for its judicious interpretation of the legislative system. Elaborating his theories of government in such works as *George Washington* (1896) and *A History of the American People* (1902), he became widely known for his eloquence and perception. As an educator he taught history and political economy at Bryn Mawr College and at Wesleyan University. Returning to Princeton as professor of jurisprudence and political economy, he was chosen president of the university in 1902. He encouraged individual instruction and became popular among the students.

Governor of New Jersey and Election as President. Wilson's reputation for scholarship and educational reform made him attractive to many leaders of the Democratic Party (q.v.) as a candidate for governor of New Jersey. Elected in 1910, he demonstrated his independence of the party hierarchy and proceeded to enact an extensive program of political and economic reform. In many of his efforts he represented the views of the reform-minded citizens known as progressives, calling for such measures as the establishment of a direct primary and the regulation of trusts (q.v.). At the Democratic national convention of 1912, he was nominated for President on the forty-sixth ballot, receiving the support of William Jennings Bryan (q.v.) and other Democratic reformers. His candidacy had been promoted by the American diplomat Edward Mandell House (q.v.), a Texas political leader, who became one of Wilson's principal advisers. Wilson's eloquent expression of a liberal political philosophy was a notable element in the campaign. Confronting a Republican Party divided between the supporters of President William Howard Taft and former President Theodore Roosevelt (qq.v.), he was elected by a large electoral majority.

The New Freedom. As President, Wilson used

his oratorical skill and his powers of persuasion to bring about the enactment of numerous reforms. Calling his program The New Freedom, he asked Congress to protect the individual citizen from undue control by great financial enterprises. Among the reform measures passed during his administration were the Underwood Tariff Act, which reduced excessive protection of industrial prices (see TARIFFS, UNITED STATES), and the Clayton Antitrust Act (q.v.), which encouraged economic competition and freed labor unions from the threat of antitrust litigation. By supporting the creation of the Federal Reserve System and the Federal Trade Commission (qq.v.) Wilson hoped to reform the banking system and prevent destructive business competition. He also favored such social legislation (q.v.) as a child-labor law and measures for the protection of workers. Distrusting the system of Federal security advocated by Theodore Roosevelt, however, he avoided extensive social-welfare proposals. His introduction of racial segregation into Federal departments was regarded as a rejection of Roosevelt's support for minority groups. Constitutional amendments adopted during Wilson's administration provided for the direct election of Senators, prohibition (q.v.), and women's suffrage.

Foreign Policy of Neutrality. In foreign affairs Wilson attempted to reverse the policy of intervention that had characterized previous administrations. He extended diplomatic recognition to the newly formed Republic of China, and he asserted that the U.S. would pay indemnities to Colombia for losses caused by the building of the Panama Canal (q.v.). In Mexico, however, his concern for constitutional government led him to encourage American intervention against the dominant regime; see MEXICO: *History*. His actions provoked the resentment of virtually all Mexicans, resulting eventually in the dispatch of American troops to pursue the Mexican revolutionary general Francisco Villa (q.v.). Similar interventions in Cuba, the Dominican Republic, Haiti, and Nicaragua were supported by Wilson in the interest of government stability and democracy.

When World War I (q.v.) began in 1914, Wilson urged Americans to "be neutral in fact as well as in name". He was distressed, however, by the German invasion of Belgium and by the loss of American lives in German submarine attacks on Allied ships. Reluctantly urging the preparation of American defenses, he advised Germany that if the war continued the U.S. might join the Allies. He subsequently made several attempts to bring all the European pow-

WILSON, (Thomas) WOODROW

ers to terms. Renominated in 1916, he narrowly defeated his Republican opponent, Charles Evans Hughes (q.v.). His victory was generally regarded as an endorsement of the policy of neutrality (q.v.). In January, 1917, however, the Germans announced their resumption of unrestricted submarine warfare, and Wilson, after



Woodrow Wilson

determining that the Germans would not hesitate to sink American ships, asked Congress for a declaration of war on April 2, 1917.

War and the Growth of Presidential Power.

To mobilize the American economy for war Wilson greatly increased the powers of the Presidency. He created governmental agencies charged with the regulation of commodity production, and he established wage and price controls. Railroads were brought under Federal authority, while military and government officials were given extensive powers over the national economy. Wilson also encouraged measures designed to suppress opposition to the war effort. He denounced the Socialist leader Eugene Victor Debs (q.v.), who was imprisoned for his pacifist beliefs. By 1918, Wilson had extended the influence of the Presidency into virtually every aspect of American life. Through his eloquent addresses, moreover, he convinced many of his countrymen of the justification of the war.

The Fourteen Points. Even before the war ended, Wilson turned his attention to the problems of the postwar period. In an address to Congress delivered on Jan. 18, 1918, he proposed a program known as the fourteen points (q.v.), which called for permanent treaties and an effective organization of nations. Although the Republicans gained control of Congress in 1918, Wilson continued to urge adoption of his program. At the peace conference in Paris, however, he was obliged to accept compromises on several issues. Having argued for "open covenants openly arrived at", he nevertheless became involved in numerous secret negotiations. His support for self-determination among the peoples of the former German colonies was largely rejected by France, Great Britain, and Japan. The resulting Treaty of Versailles (see VERSAILLES, TREATY OF) fully reflected Wilson's views only in its establishment of the League of Nations (q.v.), the measure that he had most vigorously supported. He was awarded the 1919 Nobel Peace Prize.

Rising Discontent with Wilson's Diplomacy.

When Wilson returned from Paris, he found his support for the League challenged in Congress, especially by Senator Henry Cabot Lodge (see under LODGE) of Massachusetts. He became aware also of an increasing opposition among the general public, arising from discontent with the apparent failure of his diplomacy. His preoccupation with foreign affairs, moreover, was regarded as a cause of the economic crisis that followed the release of wartime controls. Refusing to compromise with Congress on the League, Wilson determined to regain public support for his program. In September, 1919, he undertook a strenuous national speaking tour, during which he collapsed from exhaustion. He suffered a paralytic stroke when he returned to Washington, but even from his bed he refused to accept any of the proposed modifications to the League. When he realized that the peace treaty would not be ratified without such modifications, he instructed his own supporters to vote against ratification.

Following this defeat, Wilson remained physically unable to perform the functions of his office, which were carried on largely by his advisers. The election of 1920 resulted in a tremendous popular majority for the Republican candidate, Warren Gamaliel Harding (q.v.), and was widely regarded as a repudiation of Wilson's policies. During the last three years of his life, the former President was nominally associated with a law firm in Washington but seldom appeared in public. His death brought wide-

spread regret among his many admirers throughout the world.

An Evaluation in Retrospect. One of the most remarkable men ever to serve as President, Wilson has also been regarded by many historians as one of the most complex. Essentially conservative in his approach to domestic matters, he nevertheless enacted some of the most extensive reforms ever achieved in government. In foreign affairs his advocacy of democracy and world peace was accompanied by a series of events requiring intervention and war. His eloquence as an educator and orator enabled him to become an exceptionally persuasive leader, while his political skill ensured the enactment of many of his programs, though not of those that he most ardently supported. His complexity as a political leader was often considered the result of the varying elements of his personality, and many authorities have attributed his attitudes on racial matters, for example, to his Southern background, while citing the influence of his clerical upbringing as a cause of his sometimes messianic approach to world affairs. Historians generally agree, however, that Wilson brought a unique sense of dignity and moral responsibility to the office of the Presidency and that his idealism elevated American diplomacy to a level of purposeful action never before achieved. N.H.C.

WILSON, MOUNT. 1. Peak of the San Gabriel Mts. in California, a short distance N.E. of Pasadena. On its summit, 5710 ft. above sea level, is located the Mount Wilson Observatory (q.v.). **2.** Peak of the San Miguel Mts. in Colorado, about 12 miles S.W. of Telluride. The summit is 14,246 ft. above sea level.

WILSON'S CREEK NATIONAL BATTLEFIELD, area of historic interest 5 miles S.W. of Springfield, Mo., commemorating one of the battles in the struggle for control of Missouri during the American Civil War. At this site some 5000 Union troops, under General Nathaniel Lyon (1818-61), met a force of 12,000 Confederate soldiers under General Sterling Price (1809-67) on Aug. 10, 1861. The Union troops were routed and Lyon was killed. The battlefield is administered by the National Park Service (q.v.). See CIVIL WAR, THE AMERICAN.

WILTSHIRE or WILTS, Great Britain, inland county of S. England. A great part of the surface is fertile chalk upland, including Marlborough Downs in the N. In the S. is Salisbury Plain, a bare rolling upland traversed by fertile valleys. There are scattered forests. The chief streams are the Avon, the Kennet, and the Wylye. Dairying, sheep raising, bacon curing, and the growing of

barley, wheat, and oats are the leading industries. Locomotives and railway cars, textiles, rubber goods, leather, farm implements, sheet metal products, and carpets are manufactured. Some iron ore is mined and smelted. Wiltshire is rich in archeological remains, notably Stonehenge (q.v.). The largest city is Swindon; Salisbury (qq.v.) is the administrative center. Area, 1345 sq.mi.; pop. (1971) 486,048.

WIMBLEDON, Great Britain, suburb of London, England, 8 miles S.W. of the district of Charing Cross. It is a residential area and is noted as the site of the All England Lawn Tennis Club headquarters, where international tennis championship matches take place annually; the first match was held in 1877; see TENNIS. Cricket and golf also are played at Wimbledon. It has remains of a Roman earthwork and early British relics. Wimbledon is reputed to be the scene of the victory of Cealwin, King of Wessex (d. 593), over Ethelbert (q.v.), King of Kent, in 568. It was incorporated as a borough in 1905 and was absorbed into the Greater London Borough of Merton under the London Government Act of 1963.

WINCHESTER, city in Kentucky, and county seat of Clark Co., about 18 miles E. of Fayette. In the blue-grass region, Winchester is known for its livestock. Important crops, such as bluegrass seed and tobacco, are shipped from the city. A natural resource of the area is limestone. Manufactures include wood products and farm machinery. It is the site of Southeastern Christian College, founded in 1949. The headquarters for the Cumberland National Forest is here. Pop. (1960) 10,187; (1970) 13,402.

WINCHESTER, independent city in Virginia, and county seat of Frederick Co., 65 miles N.W. of Washington, D.C. It lies at the N. end of the Shenandoah Valley, a region noted for the cultivation of apples, and is one of the leading apple markets in the world. Among the industries in the city and vicinity are the processing of apple and dairy products, quarrying, and the manufacture of fruit-grading and fruit-packing equipment, barrels, textiles, and stone, clay, and glass products.

Winchester is the site of the renowned Shenandoah Apple Blossom Festival, held annually in May. The city and vicinity abound in historic landmarks. In 1748 George Washington (q.v.) was employed in Winchester as surveyor to Lord Thomas Fairfax (see *under* FAIRFAX), and during the French and Indian War (q.v.) Washington established his headquarters in Winchester in a house that still stands. Other points of interest include Christ Episcopal Church, containing the

grave of Lord Fairfax; Fort Loudon Seminary, which occupies the site of Fort Loudon built by Washington in 1756–57; and the Shenandoah Valley Military Academy (1764).

During the American Civil War numerous military engagements took place in and near the city. The Confederate general Thomas Jonathan Jackson, known as Stonewall, and the Federal commander General Philip Henry Sheridan (q.v.) had headquarters there, and both structures have been preserved. Civil War dead are buried in Stonewall Cemetery and the Winchester National Cemetery; see CIVIL WAR, THE AMERICAN.

The site of the present city was first settled in 1732, and in 1752 the town was founded. Winchester was chartered as a city in 1852. Pop. (1960) 15,110; (1970) 14,643.

WINCKELMANN, Johann Joachim (1717–68), German classical archaeologist and art historian, born in Stendal, and educated at the University of Halle. In 1755 he published his first major work, an essay entitled *Gedanken über die Nachahmung der Griechischen Werke in der Malerei und Bildhauerkunst* ("Thoughts on the Imitation of Greek Works in Painting and Sculpture"). Inspired by his study of the theory and history of art, Winckelmann went to Rome where he entered the service of Alessandro Cardinal Albani (1692–1779). His reports on the excavations at Pompeii and Herculaneum gave classical scholars the first reliable scientific information about the treasures unearthed at the sites; see ARCHEOLOGY: *History*. In 1762 he published his *Anmerkungen über die Baukunst der Alten* ("Observations on the Architecture of the Ancients"). Winckelmann's masterpiece, *Geschichte der Kunst des Alterthums* ("History of Ancient Art", 1764), surveyed the history of Greek art and set forth his theories on its fundamental esthetic principles. A classic text, it strongly influenced many writers and philosophers, including the German critic Gotthold Ephraim Lessing and the German poet Johann Wolfgang von Goethe (q.v.). Winckelmann's most notable subsequent work was his *Monumenti Antichi Inediti* ("Unpublished Ancient Monuments", 2 vol., 1767–68). See GREEK ART AND ARCHITECTURE: *Greek Revivals*.

WINCKLER, Hugo. See HITTITE LANGUAGE.

WIND, air in motion. The term is usually applied to the natural horizontal motion of the atmosphere (q.v.); motion in a vertical, or nearly vertical direction is called a current. Winds are produced by differences in atmospheric pressure, which are primarily attributable to differences of temperature (q.v.). Variations in the

distribution of pressure and temperature are caused largely by unequal distribution of heat (q.v.) from the sun, together with differences in the thermal properties of land and ocean surfaces; see METEOROLOGY: *Circulation of the Atmosphere*. When the temperatures of adjacent regions become unequal, the warmer air tends to rise and flow over the colder, heavier air. The winds initiated in this way are usually greatly modified by the rotation of the earth.

Winds may be classified into four major types: the prevailing winds, the seasonal winds, the local winds, and the cyclonic and anticyclonic winds; see CYCLONE; HURRICANE; TORNADO.

The Prevailing Winds. Near the equator exists a low-pressure belt, known as the doldrums (q.v.), which lies roughly between latitudes 10° S. and 10° N. Within this belt, sometimes called the equatorial belt of calms, the air is hot and sultry. At about 30° from the equator in both hemispheres are the horse latitudes, which are high-pressure belts of calms or light variable winds. Surface air, moving from the horse latitudes toward the low-pressure equatorial belt, constitutes the trade winds, which are the prevailing winds of the lower latitudes. In the Northern Hemisphere, the northerly wind blowing toward the equator is deflected by the rotation of the earth to become northeasterly and is known as the northeast trade wind. In the Southern Hemisphere, the southerly wind, which is similarly deflected, becomes southeasterly and is known as the southeast trade wind.

On the polar side of the horse latitudes in either hemisphere, the atmospheric pressure diminishes toward low-pressure centers in middle and high latitudes. The winds set in motion poleward by these pressure systems are deflected toward the east by the Earth's rotation. Because winds are known by the direction from which they blow, the winds in middle latitudes are known as the prevailing westerlies. These westerlies are greatly affected by travelling cyclonic and anticyclonic disturbances that cause their actual direction to change greatly from day to day.

The colder regions at the poles tend to be high-pressure centers, particularly in the Southern Hemisphere, and winds spreading out from these areas are deflected to become the polar easterlies.

The strongest wind ever reliably measured on the surface of the earth was 225 m.p.h., recorded on Mt. Washington, N.H., on April 12, 1934. There is some evidence that considerably stronger winds occur locally near the centers of tornados.

With increasing elevation above the surface of the earth, the prevailing westerlies increase in speed and their range of latitudes expands toward the equator and the pole. The trade winds and polar easterlies are thus relatively shallow, and are generally replaced by westerlies above a few thousand feet. The strongest westerlies occur at heights of 6 to 12 mi., and tend to be concentrated in a rather narrow belt called the jet stream, where wind speeds as high as 340 m.p.h. have been measured.

The Seasonal Winds. The air over the land is warmer in summer and colder in winter than the air over the adjacent oceans during the same seasons. During the summer the continents thus become seats of low pressure, with winds blowing in from the colder oceans. In the winter the continents are seats of high pressure, with winds directed toward the warmer oceans. These seasonal winds are typified by the monsoons (q.v.) of the China Sea and the Indian Ocean.

The Local Winds. Corresponding with the seasonal variations in temperature and pressure over land and water, diurnal changes occur, which exercise a similar but more local effect. Especially in the summer, the land is warmer than the sea by day and colder than the sea by night. The variations of pressure thus induced evoke a system of breezes directed landward during the daytime and seaward at night. These land and sea breezes penetrate to a distance of about 30 mi. on and off the shore.

Similar daily changes in temperature occur over irregular terrain and cause mountain and valley breezes. Other winds induced by local phenomena include whirlwinds and winds associated with thunderstorms.

Beaufort Wind Scale. The Beaufort wind scale is used by mariners and meteorologists to indicate wind velocity. It was devised in 1805 by the Irish hydrographer Francis Beaufort (1774–1857). His original designations were modified subsequently; the scale in present-day use at sea is given in the following table.

Beaufort Scale	Wind Speed in m.p.h.	Seaman's Description
0	below 1	Calm
1	1–3	Light air
2	4–7	Light breeze
3	8–12	Gentle breeze
4	13–18	Moderate breeze
5	19–24	Fresh breeze
6	25–31	Strong breeze
7	32–38	Moderate gale
8	39–46	Fresh gale
9	47–54	Strong gale
10	55–63	Whole gale
11	64–75	Storm
12	above 75	Hurricane

A.K.B.

WINDAUS, Adolf (1876–1959), German biochemist, born in Berlin, and educated at the universities of Berlin and Freiburg. He taught successively at the universities of Freiburg and Innsbruck and served (1915–44) as professor of chemistry and director of the chemical laboratory at the University of Göttingen. He was awarded the 1928 Nobel Prize in chemistry for his work defining a group of sterols, including cholesterol, and their connection to vitamins. His work on vitamin D proved that ultraviolet light activates ergosterol, preventive of the disease rickets. See VITAMIN: *Vitamin Groups: Vitamin D*.

WIND CAVE NATIONAL PARK, area of national interest in South Dakota, in Custer Co., 10 miles N. of the town of Hot Springs. The chief attraction is a limestone cave consisting of innumerable galleries and chambers with unusual boxwork and frostwork formations; stalactites and stalagmites are practically nonexistent. Discovered in 1881, the cave takes its name from the strong wind currents which blow in and out of the entrance according to the changes in the barometric pressure outside. The temperature inside the cave is a constant 47° F. all year. The park is also a preserve for buffalo, antelope, elk, deer, and prairie dog towns. The park is administered by the National Park Service (q.v.).

WINDERMERE, LAKE, Great Britain, largest lake in England, in the s.e. Lake District (q.v.), and forming part of the boundary between Lancashire and Westmorland. The lake is 10½ mi. long and almost 1 mi. wide; its maximum depth is 210 ft. Among the streams flowing into Lake Windermere are the Rothay, Brathay, and Trout Beck, and it is drained by the Leven, that empties into Morcambe Bay in the Irish Sea. There are several small islands. The shore line is high, luxuriantly wooded, and broken by many tiny inlets. Long celebrated for its scenic beauty and well stocked with fish, Windermere is frequented by tourists and fishermen. At the N. extremity of the lake is Rydal, once the home of the British poet William Wordsworth (q.v.).

WINDFLOWER. See ANEMONE.

WINDHOEK, town and capital of South West Africa, on a plateau 5428 ft. above sea level about 150 miles E. of Walvis Bay. The town is the center of rail and air transportation for the entire territory. Products of the surrounding region consist principally of lead, silver and copper ores, salt, cattle, and pelts of Karakul sheep. Local industries include meat packing, brewing and the operation of cold-storage plants. Several schools are located in Windhoek, and it is also the seat of Anglican and Roman Catholic bish-



A windmill (rear view) at Zevanauizen, the Netherlands, showing the mechanism used to keep the arms facing into the wind
 Vance Henry-Taurus Photos

oprics. A Hottentot town (see HOTTENTOTS) until German settlers took possession of it in 1890, Windhoek became the capital of German South-West Africa in 1892. Armed forces of the Union of South Africa (now Republic of South Africa) occupied the town in 1915 during World War I. In 1920, the League of Nations (q.v.) granted the Union of South Africa the mandate over South-West Africa, and Windhoek was made the capital of the territory. Pop. (1972 est.) 64,095.

WIND INSTRUMENTS. See MUSICAL INSTRUMENTS: *Wind Instruments*.

WINDMILL, wind-driven machine, usually operated by the wind acting on oblique vanes or sails radiating from a horizontal shaft. Windmills were introduced into the countries of central Europe about the 12th century and remained an important source of power until they were largely displaced by the steam engine at the end of the 18th century. They have been made almost completely obsolete in the 20th century, except in the Netherlands, by the internal-combustion engine (q.v.) and by electrical power; see DYNAMOELECTRIC MACHINERY.

Original Design and Early Uses. In the early form of windmill, the mill building, usually built in the form of a truncated cone or pyramid, was

surmounted by a rotatable cap carrying a horizontal shaft bearing a wind wheel of four to six radial, canvas-covered vanes, each 10 to 30 ft. in length. The cap could be turned to bring the wind wheel facing into the wind, and the power generated was transmitted through a system of gears and shafting to the mill machinery, usually for grinding corn, at the base of the building.

With the development of the Middle West in the United States during the second half of the 19th century, the use of the windmill again became popular. They were used for pumping water from wells to elevated tanks or reservoirs, and recently for generating electric power.

Windmills Today. Modern windmills may be divided into three main types, the multivaned wheel, known also as the American type; the propeller type; and the S-rotor type. The American-type windmill uses a wheel, usually from 6 to 16 ft. in diameter, with a number of oblique blades or sails radiating from a horizontal shaft. The wheel is mounted on a tower high enough to permit unobstructed action by the wind. A large, rudderlike vane directs the wheel into the wind; when wind velocities become excessive, safety devices automatically turn the wheel out of the wind to prevent damage to the mechanism. Although the multivaned windmill is the least efficient of all modern types, it is used extensively in rural areas as an inexpensive apparatus for pumping water.

WINDOW

Propeller-type windmills, often employed as a source of electric power, have two to four large, variable-pitch blades, mounted on a high-speed wheel geared to a dynamo. Regulation of the speed of the wheel is achieved by adjusting the pitch of the blade to maintain a constant speed of 30 revolutions per min. for wind velocities between 15 to 70 m.p.h. As in the multivane type, the propeller type also has a vane to keep its working surfaces facing into the wind. See PROPELLER.

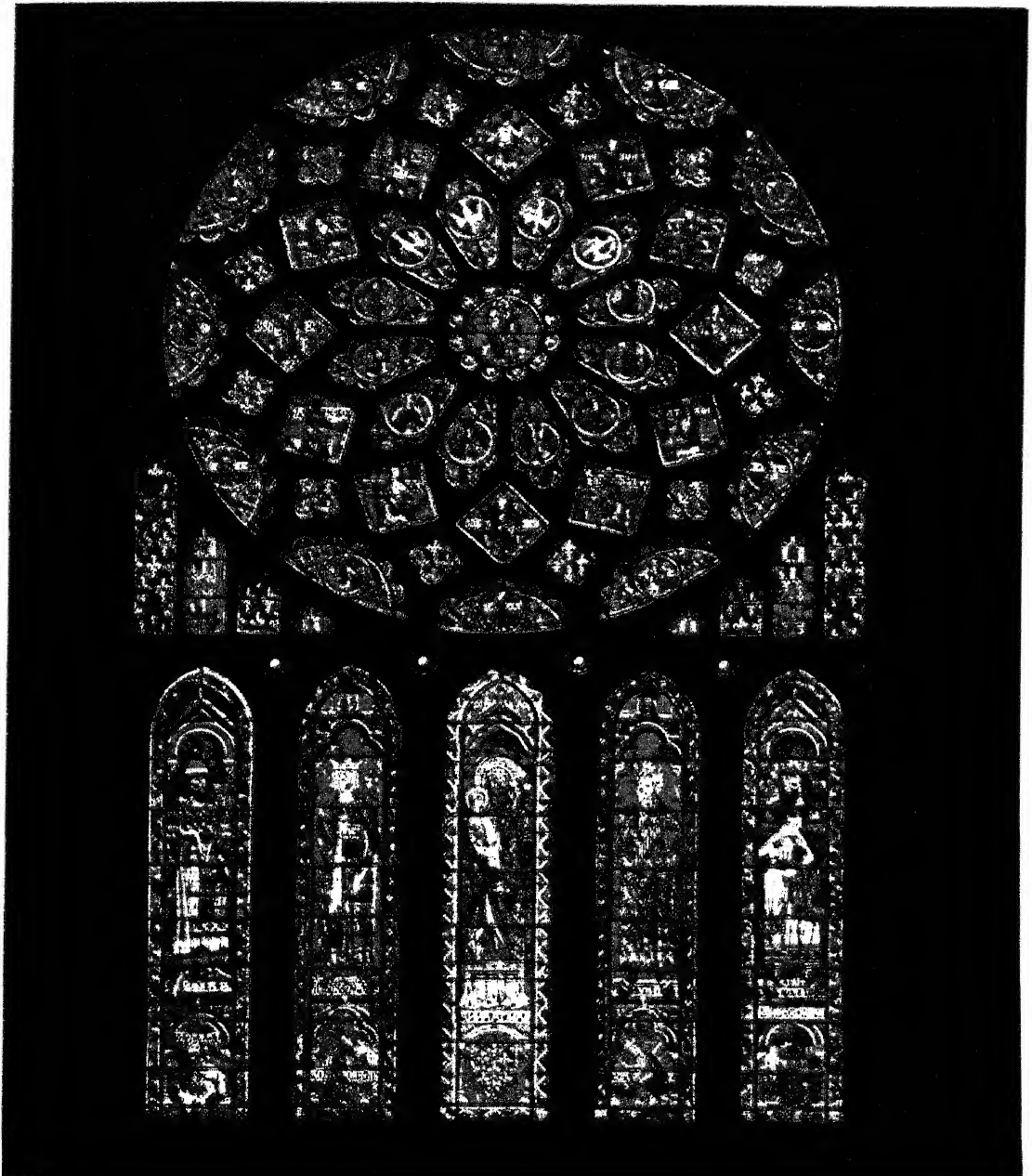
The third type of windmill employs an S-shaped rotor mounted on a vertical shaft. It is

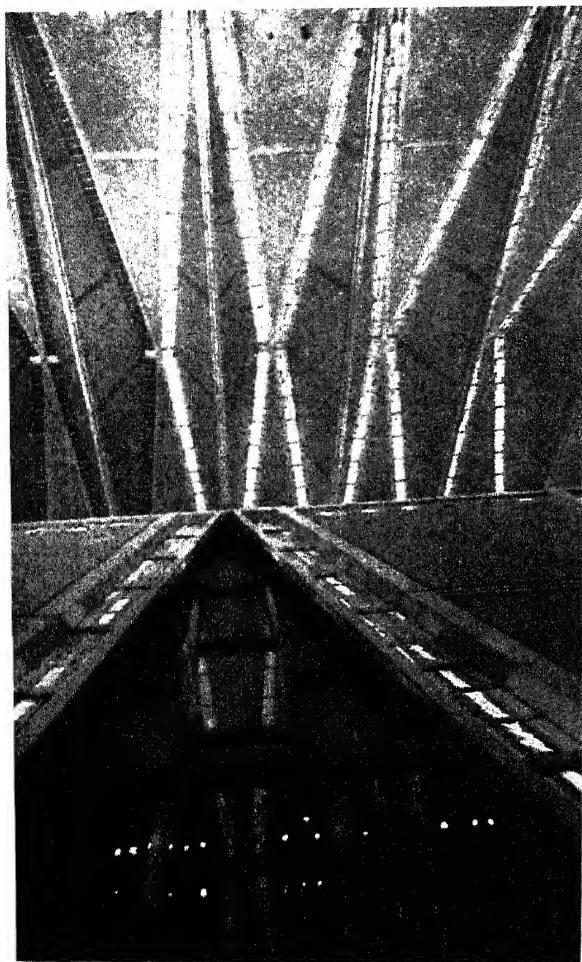
the only type of windmill that requires no rudder, as its rotor develops power regardless of the direction of the wind.

WINDOW (Old Norse *Vindauga*, "windeye"), opening in the wall of a building, covered usually with a transparent material and designed generally to admit light and control the flow of air. Modern windows consist of wood or metal frames, called sashes, set with panes of glass.

The 13th-century north rose window in the renowned Cathedral of Notre Dame, Chartres, in northern France. The five lancets below portray characters from the Bible.

Scala





Modern stained-glass windows between the tetrahedrons that form the walls and pinnacled ceiling of the Protestant chapel, U.S. Air Force Academy, Colorado.

Myron Wood-Photo Researchers

The slow evolution of window design through the centuries has been governed by the lighting and ventilation needs of each civilization, by military considerations, and by the nature and cost of available building materials. Windows doubtless originated in prehistoric times as holes in the roofs of thatched huts. The hole served as a chimney and provided light and ventilation. In the Hebrides, off the coast of Scotland, the so-called black house, which has this type of window-chimney, is still in use. Architects conjecture that with the development of clay pipes and other means of carrying off smoke, windows became openings in walls instead of roofs. Covered with animal skins, these openings provided an easily controlled supply of light and fresh air.

Early Designs. The clerestory, the oculus, the glass window, and other lighting devices made their first appearance with the rise of ancient

Egypt, Greece, Rome, and other Mediterranean civilizations. Because of the mild climate in the Mediterranean region, private dwellings were easily provided with air and sunshine. The dark interiors of the vast temples and public buildings of antiquity, however, posed a definite lighting problem. In Egypt the problem was partly solved by lighting plans such as that used in the great temple at El Karnak (q.v.). The center section of the temple roof was elevated and the walls of the clerestory thus created were fitted with finely perforated stone, which allowed sunlight to illuminate the temple interior. In Greece the temples were lighted by the use of windows set with perforated wood or stone. The Romans, in their most ambitious attempt to achieve interior lighting in the daytime, constructed an impressive oculus, or opening, at the apex of the great central dome of the Pantheon (q.v.) in Rome; it is believed that the oculus was set with mica or some other translucent material.

Roman architects placed considerable emphasis on window design, for several reasons. Much of the wealth drawn from the empire was expended on magnificent interiors for public buildings, private villas, and town houses. To illuminate these rich interiors Roman architects made use of windows to an unprecedented extent. Of equal importance, Roman artisans were able to produce window glass on a scale previously unknown. The glass was thick, wavy, blue-green, and marred by bubbles, but it proved serviceable. The glassmaking industry practically disappeared after the fall of the Roman Empire, and it was not reestablished in Europe until several centuries later.

Middle Ages. During the Middle Ages window designing developed unevenly, secular design declining and ecclesiastical design reaching remarkable heights. The decline in the secular field occurred mainly because glass was scarce, poor in quality, and very expensive. Secondly, the main secular buildings of the early medieval period were castles, and under restrictions imposed by feudal lords, who were forced to think in terms of military assaults and sieges, castle windows were mere slits in thick stone walls. In the relatively safe, walled, medieval towns and cities, however, private homes and public buildings were occasionally provided with windows containing panes of parchment, oiled paper, or other translucent materials.

Medieval ecclesiastical architects, at liberty to exercise their creative talents, employed recent technical discoveries and the immense resources of the Church to develop new concepts

in window design. Among the technical advances was tracery, an ingenious method of constructing huge stained-glass windows; eventually the latter almost entirely occupied the fronts and transepts of cathedrals. Towering, vaulted windows displaced the squared and rounded-top types formerly in vogue, giving the immense edifices a soaring, ethereal aspect. Another striking innovation in medieval ecclesiastical architecture was the rose window, a circular type characterized by a wealth of intricate patterns. See ARCHITECTURE; GLASS, PAINTED AND STAINED.

Renaissance. During the Renaissance architects rejected the gigantic vaulted windows of the medieval period and created or adopted various other window designs. Believing that a building with excessive window area looked insubstantial and unstable, they developed fenestration, a system of balancing window area to wall area. Square and round-topped windows returned to favor, and the chief distinction between the windows of churches and secular buildings disappeared. Concurrently the use of tracery and the art of making stained glass declined, although a few fine examples were produced in Florence and in northern France and Belgium during the early Renaissance. During the High Renaissance window openings were decorated elaborately with carved ornaments, and, in the Baroque Age, with grotesque scrolls, masks, and carved figures. During the late Renaissance large casement or French windows became popular in France, and the double-hung window was adopted in England.

Modern Constructions. Windows designed for modern homes are commonly double-hung and casement types. Double-hung windows have two sashes of equal size that slide up and down in grooves and are counterbalanced by weights. A disadvantage is that only 50 percent of the window area may be used for ventilation, thus reducing its efficiency during hot weather. Casement windows are hinged at the side and may swing either in or out. French windows are casement windows that usually extend to the floor and open like folding doors.

Several other types of windows also appear in modern homes. Top-hinged windows swing in or out, awning-style. Pivoted-sash windows open and close by swinging on a central axis. Horizontal-sash windows, popular in the Orient, slide back and forth horizontally across the wall opening. Picture windows are set with outsize panes of special glass; such windows allow a sweeping view but cannot be opened as a general rule. Bay windows project outward

from buildings, adding to the floor space within. Bay windows with curved or rounded exteriors are called bow windows; those protruding from upper stories and supported by a corbel, or bracket, are called oriel windows. Dormers, the windows in gables, protrude from steeply sloping roofs. Storm windows are auxiliary windows mounted in front or in back of other windows. The layer of air between the two glass surfaces inhibits the penetration of cold and the loss of warmth. Jalousies are shutters with adjustable slats, used in the tropics and other hot-weather areas to control heat and sunlight.

Some of the types of windows outlined above are utilized in business and industrial establishments, but the latter often require special functional designs. Among the more common are display windows, large expanses of plate glass that allow the merchant to exhibit his goods to advantage, and skylights, windows set into roofs. In order to ensure a maximum of diffused overhead light, industrial structures often are equipped with rows of slanting, frosted-glass skylights.

The trend in modern architecture is toward a great increase in window area. Such structures as the United Nations and Lever Brothers' buildings in New York City have walls made almost entirely of glass. Other structures, usually factories, often have no windows at all, light, temperature, and ventilation being controlled artificially.

WINDPIPE. See TRACHEA.

WIND RIVER RANGE, range of the Rocky Mountains (q.v.) in W. Wyoming, that runs N.W. and S.E., forming part of the Continental Divide, the mountain range that separates the W.-flowing streams from the E.-flowing streams in North America. The Green R. rises in the S.W. slope of this range, while many tributaries of the Wind R. flow off on the N.E. side. The range contains Fremont Peak (13,730 ft.) and Gannett Peak (13,785 ft.); the latter is the highest point in Wyoming.

WINDSOR, city and port of entry of Canada, in Ontario Province, and county seat of Essex County, on the Detroit R., opposite Detroit, Mich., with which it is connected by bridge, vehicular tunnel, and ferry. A major transportation center, Windsor provides a link, by railway tunnel, between Canadian and United States railways, and is also an important airline terminal. Windsor is surrounded by a rich agricultural region noted for the cultivation of fruits, tobacco, and general farm products. The city is the leading automobile-manufacturing center of Canada and contains factories producing pharma-

WINDSOR

ceutical products, paint, varnish, processed salt, beer, and electrical appliances. Among the institutions of higher learning in the city is Assumption University (1855). Jesuit missionaries settled in the vicinity of Windsor in 1640, but modern development of the site dates from the early 18th century, when French farmers established themselves nearby. Known successively as The Ferry, Richmond, and South Detroit, the community received the name Windsor in 1836, after Windsor, England. It was incorporated as a village in 1854 and as a city in 1892. Pop. (1976) 196,526.

WINDSOR, name of the royal family of Great Britain, adopted in 1917 by proclamation of the British king George V. The change was made to show the antipathy of his British subjects toward Germany during World War I. The name was taken from Windsor Castle (q.v.). Reigning members of the House of Windsor have been George V, Edward VIII, George VI, and Elizabeth II (qq.v.).

Prior to adoption of the Windsor name, the dynastic designation of the British royal family had been Germanic, derived from the marriage of the British queen Victoria to a cousin, Albert of Saxe-Coburg-Gotha (qq.v.). Under the terms of the 1917 proclamation, descendants of Victoria in the male line who were also British subjects were to bear the surname Windsor. In 1952 these terms were applied by decree to the male issue of Queen Elizabeth II. In 1960, however, the preceding decree was modified to give Elizabeth II's descendants, except the House of Windsor made up of her children and others titled royal highness, prince, or princess, the family name Mountbatten-Windsor, acknowledging the surname of her husband, Prince Philip (q.v.).

See also GREAT BRITAIN: *History: The Victorian Age: World War I.*

WINDSOR, Duke of. See EDWARD VIII, King of Great Britain.

WINDSOR CASTLE, principal residence of the British sovereigns, situated in the municipal borough of Windsor, or New Windsor, Berkshire, England, about 22 miles w. of London. The site is located N.E. of the town on a slight elevation overlooking the Thames R. Home Park adjoins the castle on the N., E., and S.; Windsor Great Park, about 5 sq.mi. in area and largely a public park, lies to the S. of Home Park. Noteworthy features of the grounds include a magnificent tree-lined avenue, more than 3 mi. long, leading from Home Park into Great Park, and Virginia Water, a lovely artificial lake.

The dominant structure of Windsor Castle is the Round Tower, or Keep, 80 ft. high, built on the site where, according to tradition, King Ar-

thur (q.v.) sat with the Knights of the Round Table. It was used as a prison until 1660 and is still surrounded by a moat. Another distinctive building is Saint George's Chapel, begun about 1474 by King Edward IV and completed in 1528 by King Henry VIII (qq.v.). The chapel, with its detailed stone vaulting, is a masterpiece of late Perpendicular (q.v.) architecture. It is the burial place of ten British sovereigns. The adjoining Albert Memorial Chapel, originally built as a memorial to the Saxon king Edward the Confessor (see under EDWARD) by King Henry III, was lavishly restored by Queen Victoria as a monument to her husband Albert (qq.v.), the prince consort, whose name it now bears. The state apartments in the Upper Ward, including the celebrated Saint George's Hall, the Waterloo Chamber, the Throne Room, the Rubens Room, and the Van Dyck Room, contain valuable collections of paintings, statuary, and other priceless art objects. Frogmore, the mausoleum of Queen Victoria and her husband, is in Home Park.

Old Windsor was a residence of the Saxon kings before the Norman Conquest. King William I (q.v.), who came from Normandy and successfully seized the English throne, built a castle at the present site about 1070. It was extended by his successors and was virtually rebuilt about 1344 during the reign of King Edward III (q.v.) as a gathering place for the knights of the Garter, whose insignia line the walls of St. George's Chapel and whose investitures are still held in St. George's Hall; see GARTER, ORDER OF THE. Later British monarchs added to and improved the castle.

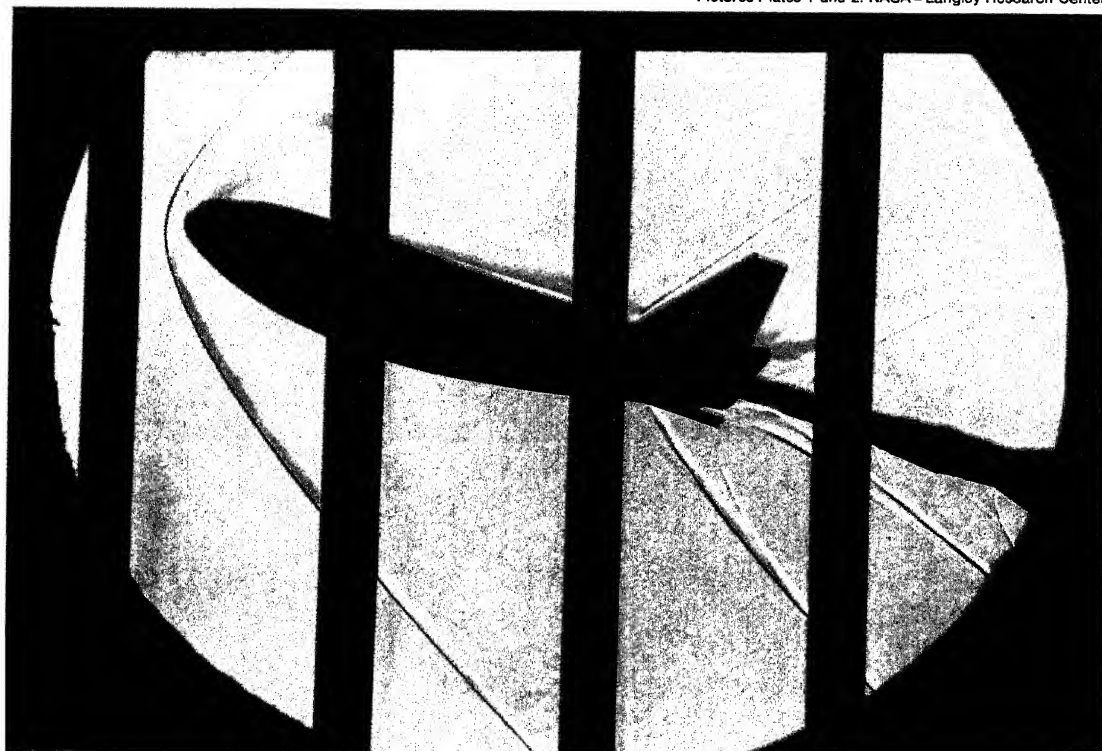
WIND TUNNEL, in aeronautics, research apparatus that simulates the flight conditions encountered by an airplane (q.v.) in flight. Wind tunnels have been used since the days of the Wright brothers (see under WRIGHT) to study the aerodynamic forces, moments, pressures, and temperatures acting on airplanes. Wind tunnels are used today to study the behavior of jet engines and to help design supersonic aircraft and manned spacecraft for flight through the atmosphere. See AERODYNAMICS; FLIGHT, THEORY OF; SUPERSONICS.

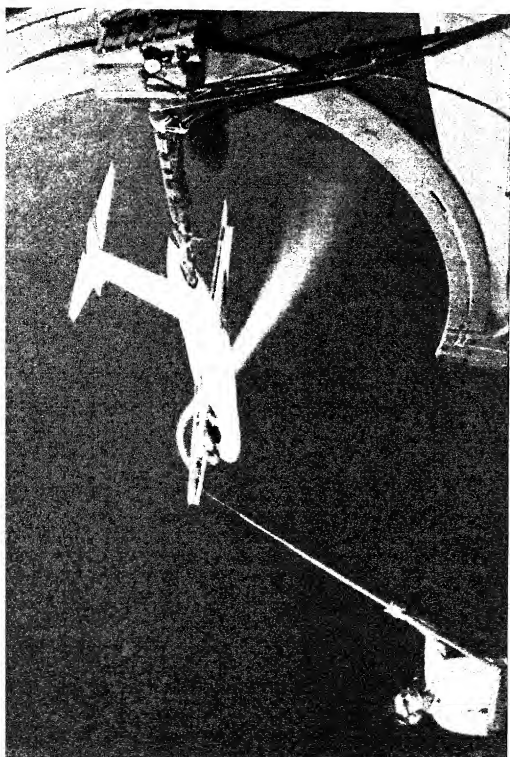
Size. Wind tunnels vary in size from a few inches to the 40-ft. by 80-ft. tunnel located at the Ames Research Center of the National Aeronautics and Space Administration (q.v.), or NASA, at Moffet Field, Calif., which can accommodate a full-size aircraft with a wingspan of 72 ft. The larger the cross-sectional area of the test section, where the model is located, the more difficult it is to develop and sustain high-speed



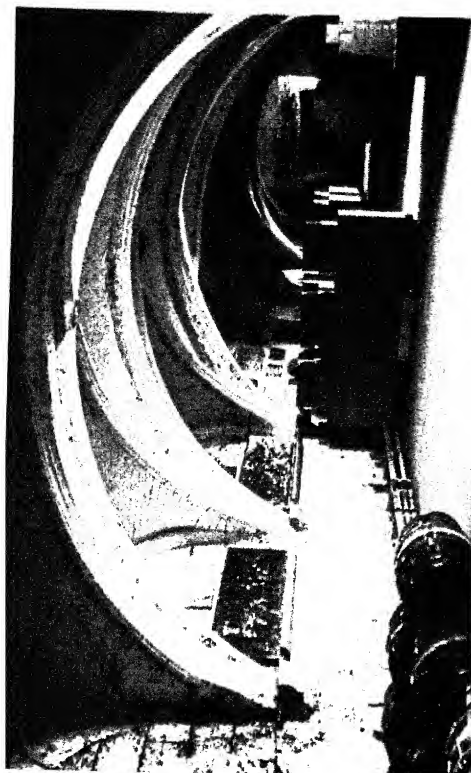
Wind Tunnel. Plate 1. Two photographs showing different types of shock and expansion waves created by the passage of a supersonic projectile through a dense airflow. The model being tested here, for aerodynamic stability and control characteristics at hypersonic speeds, is the wingless reentry vehicle HL-10. The experiment is aimed at determining the capability of the craft to land on earth like a conventional airplane after reentry from outer space.

Pictures Plates 1 and 2. NASA - Langley Research Center



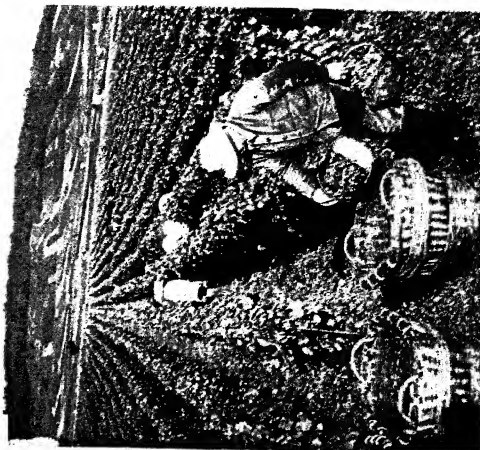
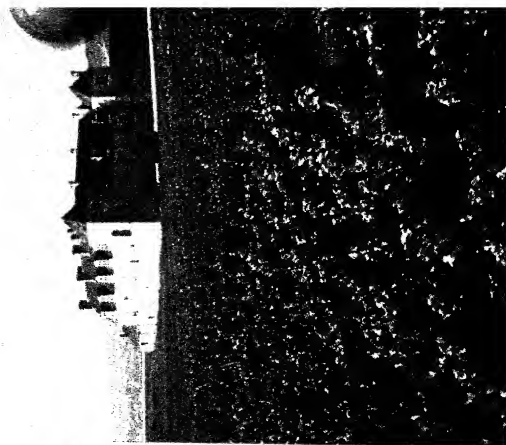


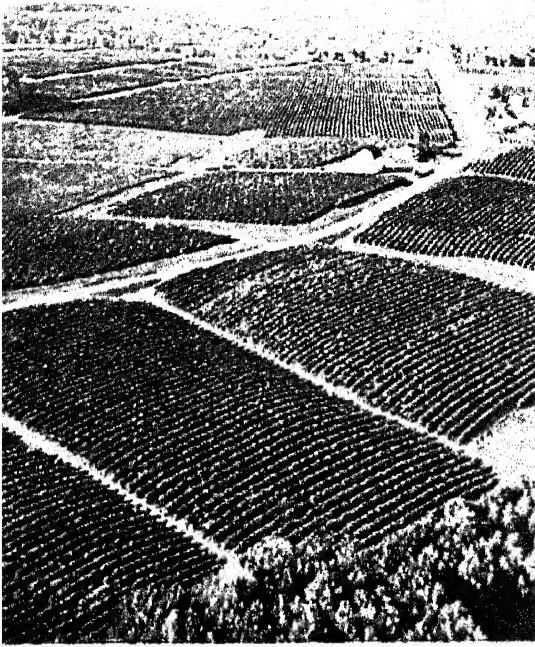
Wind Tunnel. Plate 2. Above: Research in subsonic aerodynamics is also carried out in wind-tunnel apparatus to determine the high-lift performance required for advanced short takeoff and landing (STOL) aircraft. Visible smoke shows how the flow of air around the model is used to indicate the lift produced by a particular configuration of the flaps. Below: A 1/4-scale model of the Republic F-105 fighter-bomber is mounted in a pressure tunnel for drag-study tests.



Wine. Plate 1. Above: In a large wine cellar in Cognac, a town in the Charente Department of France where the noted brandy is distilled, the desired taste and aroma are achieved. Below, left: Grape fields and workers in the Champagne region, which produces the famous sparkling white wine. Below, right: The Château Clos Vougeot and grape fields near the Côte d'Or Department of France. This area produces high quality red and white Burgundy table wines.

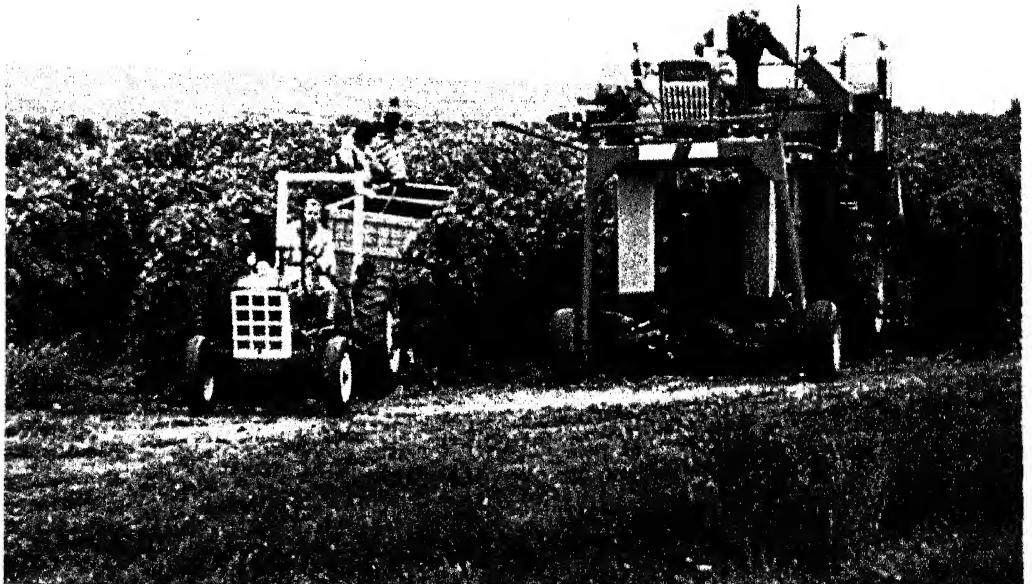
French
Tourist Office





***Wine. Plate 2.** Above, left: Vineyard-bearing slopes near Hammondsport, N.Y., where grapes native to the U.S., *Vitis Labrusca*, are grown. Above, right: A young lady handpicks sun-ripened grapes. Below: A mechanical grape picker removes large quantities of grapes very quickly.*

Taylor Wine Company



airflows. This factor is especially important for supersonic and hypersonic tunnels in which power requirements are so great that the size of the tunnel must be kept much smaller. Although large low-speed wind tunnels can use motor-driven propellers to circulate the air, higher speeds require air compressors, and eventually the release of gas stored under high pressure, or the explosive discharge of gases. These so-called blowdown and shock tunnels permit only intermittent operation. The highest velocities are obtained in the hypervelocity tunnel of the Ames Research Center, in which small models of aircraft or spacecraft are propelled by an explosive charge into the wind tunnel in one direction, while another explosive charge simultaneously drives gas into the tunnel from the other direction. These simulated test-flight conditions reach relative velocities of up to 30,000 m.p.h. and last two-hundredths of a minute.

Special Tunnels. Optical measurements are usually introduced into high-speed tunnels. Smoke is added in a low-speed tunnel so that the movement of the air over aircraft wing sections can be directly observed.

During the flight of supersonic aircraft, heating effects because of friction (q.v.) become important; see **HEAT TRANSFER**. To study these effects, special wind tunnels are used in which a jet of hot gas flows over the model. Other specially designed tunnels permit the simulation of very high altitudes and the observance of their influence on aircraft performance. Altitudes of up to 90 mi. have been simulated, and these high-altitude tests are also very important for predicting the performance of jet engines under all flight conditions; see **JET PROPULSION**. A special tunnel at the Lewis Flight Propulsion Laboratory of NASA at Cleveland, Ohio, can test full-size jet engines at air velocities of up to 2400 m.p.h., and at altitudes of up to 100,000 ft. See also **AIRPLANE**: *Principles of Flight: Problems of Supersonic Flight*; **ASTRONAUTICS**: *The Physics of Space*.

WINDWARD ISLANDS, in physical geography, a chain of islands forming part of the West Indies and situated at the s. end of the Lesser Antilles. The n. extremity of the islands lies approximately at lat. 16° N.; the s. extremity lies at about lat. 12° N. The approximate easternmost and westernmost limits of the islands are delineated by long. 60° W. and long. 62° W., respectively. The area of the Windward Islands is 1412 sq.mi. The population (1970 est.) was 675,000; the United Nations estimated (1971) 702,000. The principal islands are Dominica, Grenada, Martinique, Saint Lucia, and Saint Vincent.

In political geography all of the islands belong to Great Britain, except Martinique, which is an overseas department of France. Dominica, Grenada, St. Lucia, and St. Vincent are members of the West Indies Associated States (see **WEST INDIES**: *Political Divisions*). Grenada and St. Vincent share jurisdiction over the Grenadines. For additional information, see separate entries on the individual islands.

WINDWARD PASSAGE. See **CARIBBEAN SEA**; **CUBA**.

WINE, beverage produced by alcoholic fermentation of grape juice, produced in many parts of the world. Wines in which all the sugar has been fermented away are known as dry, in contradistinction to sweet wines, in which sugar in varying amounts is left in the wine.

CLASSIFICATION

Wines are grouped into four classes according to use, namely appetizer wines, red dinner wines, white dinner wines, and sweet dessert wines. The effervescent, or sparkling, wines, which constitute a fifth class, are popular substitutes for those of the other four. Dry sherry and vermouth are examples of appetizer wines, which are usually served before meals. Among the red dinner wines, which are served with steak, chops, and other red meats, are Burgundy, claret, Pinot Noir, and Cabernet. The white dinner wines, including Sauterne, Chablis, Rhine wine, Chardonnay, and Pinot Blanc, are served with seafood, chicken, and other mild-tasting dishes. A popular all-purpose table wine is rosé, a pink wine with a fresh-fruit flavor. The sweet dessert wines are heavier in body and have a higher alcoholic content than dinner wines. The dessert wines, port, muscatel, Tokay, and white port, are enjoyed at meals with dessert and with between-meals refreshments. The sparkling wines are champagne, sparkling Burgundy, and pink champagne.

Serving each type of wine at the proper temperature is important to its enjoyment. Sparkling wine should be served at a temperature of about 45° F.; white dinner wines should be well chilled, and appetizer wines taste best after being chilled for a short period. Red dinner wines and dessert wines should be served at room temperature or slightly chilled.

CHARACTERISTICS

Although no two wines are exactly alike, those of the same class often have similar characteristics. The appetizer wines sherry and vermouth both contain 18 to 20 percent alcohol by volume, but sherry has a rich, nutlike flavor, whereas vermouth is piquant and aromatic. Sherry may be pale to dark amber in color and

Workers crush grapes in the production of wine (from a 14th-century illustrated manuscript).

French Embassy Press & Information Div.



varies from dry to sweet in taste. Vermouth may be light dry or dry, as in the French type, or sweet, as in the Italian type. The French type of vermouth is pale amber or near-white in color and light-bodied; the Italian type is darker amber and medium-bodied.

Most white dinner wines have an alcoholic content of from 10 to 14 percent by volume, range in color from pale straw, often with overtones of green, to deep gold, and vary in taste from extremely dry and tart to sweet and full-bodied. Red dinner wines have the same alcoholic content as the white wines, but are completely dry, with rich, sometimes tart and even astringent flavors, except for rosé, which may be dry to semisweet; in California, a few red wines are marketed as Vino Rosso and range from semisweet to moderately sweet in taste.

Dessert wines are medium sweet and full-bodied, range in color from pale gold to red, and usually contain 18 to 20 percent alcohol. Sparkling wines, which vary from 10 to 14 percent in alcoholic content, may be red, pink, or

white, and completely dry to slightly sweet.

Although the basic principles of production are essentially the same, such characteristics as color, effervescence, and certain flavors are achieved by variations in the production process. In the red dinner wines the juice is fermented with the whole grape, including the skin, to extract the color. The white dinner wines are fermented from the juice alone and thus acquire little or no color. Rosé wine is fermented with the skins for a short time until it becomes pink; then the juice is drawn off and fermentation is completed without the skins. Brandy is added to appetizer and most dessert wines during production, usually to prevent the natural grape sugar from being fermented out completely. Sherry derives its nutlike flavor from a high-temperature treatment, from flor (flower) yeast fermentation, from a special system of aging, or from a combination of two or all three of these factors. Vermouth obtains its piquant and aromatic flavor from special herbs used in the production process. Sparkling wines are pre-

pared by subjecting dinner wines to a second fermentation within the bottle or other closed container; the type of dinner wine used, whether red, pink, or white, determines the color of the sparkling wine.

WINE PRODUCTION

France and Italy lead among wine-producing countries, at least so far as value of production is concerned. The annual worldwide yield of wine in the mid-1970's was about 9,660,000,000 gal., of which France and Italy together produced about 43 percent.

Famous French wines include red and white Bordeaux wines, red and white Burgundies, and champagnes. Hermitage is a well-known wine of the Rhône valley, as are Châteauneuf-du-Pape and Côte Rôtie. Germany is famous for its hocks and Moselles; Austria produces many different wines, but exports very little; Hungary is most famous for its Tokay; Spain is known for its sherry and Spanish red wines, Portugal for its port, and Italy for Lachryma Christi, Chianti, and Marsala.

In the United States, by virtue of its wide range of soil and climate, all classes of wines, many of which are of excellent quality, are produced. About 85 percent of U.S. wines are produced in California.

Some of the European names for wines, particularly those with a geographical connotation, were adopted in the newer wine-growing countries for wines with generally similar characteristics. When used outside the country where the prototype originated, the generic name of the wine is identified with the place of production. For example, a sherry produced in California is labeled a California sherry or an American sherry.

In the successful production of wine, great discretion, unrelenting care, and wide experience are essential. Climate, location, soil, grape variety, vintage, and method of preparation profoundly influence the character and composition of wine, and uniformity of the product is exceedingly difficult to maintain. The production of wine begins with the growing of the grapes and ends only after the final racking of the finished product. See GRAPE.

AMERICAN WINES

Wine grapes in the U.S. are varieties of two principal species, *Vitis vinifera*, or European wine grape, and *V. labrusca*, or native American wine grape. Practically every wine grape grown in California is of the European variety; those of

Young grapevines in precise patterns cover a vineyard in the Napa Valley of California. California Wine Growers



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the remaining viticultural areas in the U.S. are native to the continent or are hybrids.

History. Grapes were found growing in great profusion along the eastern seaboard by the Norse explorer Leif Ericson (q.v.) and others, and Vinland, or Wineland (q.v.), was the name applied to the new continent in Norse literature for many years. Later, the first settlers in Virginia, Massachusetts, and other parts of the east encouraged grape growing, but attempts to make a palatable wine from the native grapes were futile.

As long ago as 1616 expert French vineyardists were sent to Delaware with cuttings of the best obtainable vines, but 200 years later it was still impossible to acclimate European grapes to the soil and climate of the Atlantic seaboard. In the late 1700's John James Dufour (1763-1827) thought he had cultivated a European vine, but this Kentucky pioneer was actually growing a wild native vine; however, it was his efforts which gave the first encouragement to the development of the American wine grape.

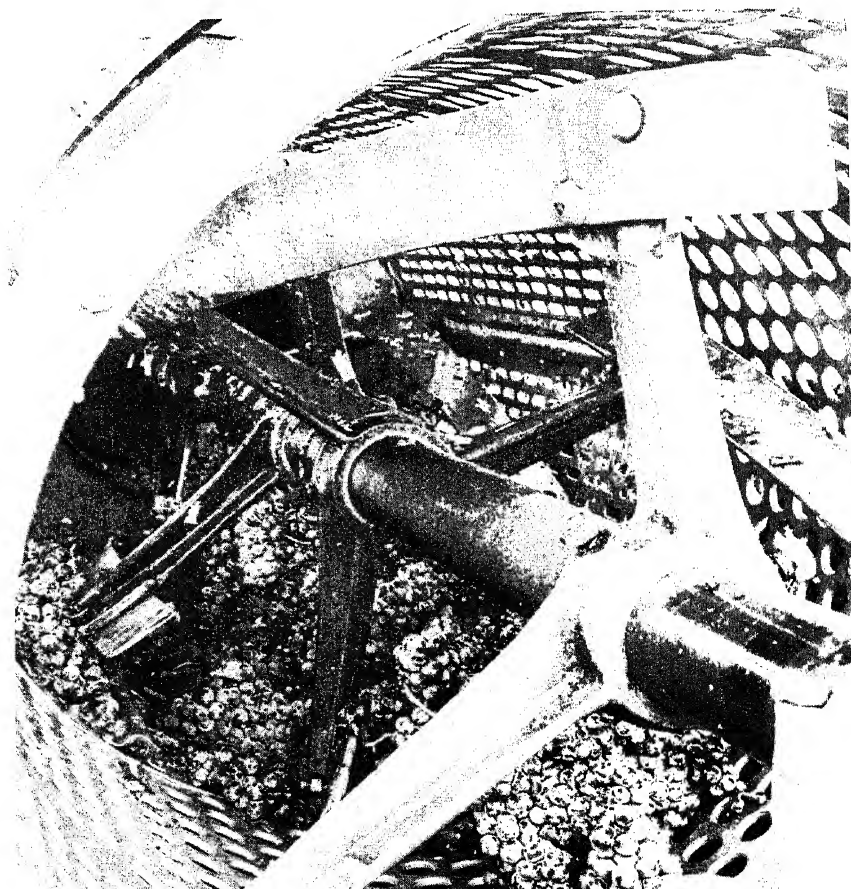
Many years of careful crossbreeding and cultivation eventually domesticated a number of native grapes for wine making, important examples being the Catawba, Concord, Delaware,

Ives, Niagara, Norton, and Scuppernong. By the middle of the 19th century a large and important wine industry built upon native grapes had been developed in New York, Ohio, New Jersey, Michigan, and other States.

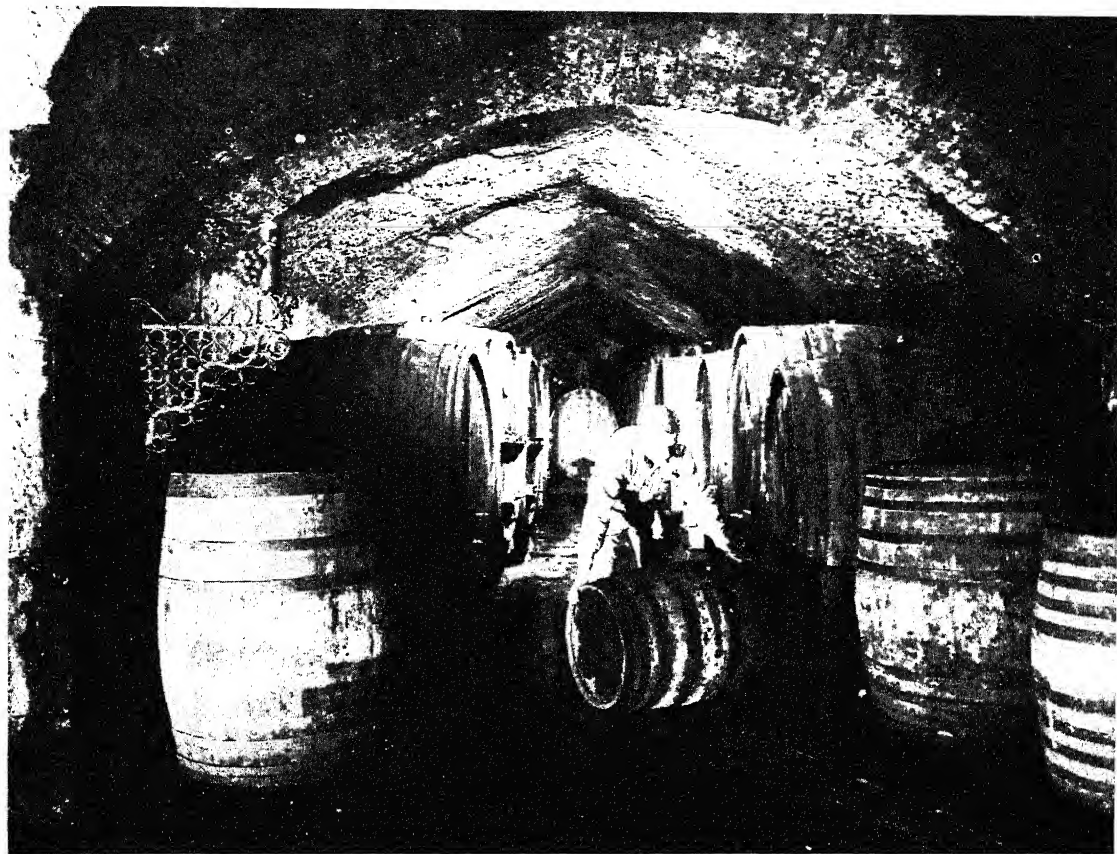
The growing of wine grapes also spread northward from Mexico into California when Jesuit missionaries, and later the Franciscans, established their missions along the Pacific Coast. Padre Junípero Serra (q.v.) founded Mission San Diego in 1769 and planted vines there when he found that the soil and climate were especially suited to the growth of the grape.

These grapes, never clearly identified, are known as the Mission, and it was upon this type that early commercial winegrowers in California built their vineyards and their wineries. Until about 1824 the Franciscans were the only winegrowers in California, but in that year Joseph Chapman, one of the first Americans to settle there, set out 4000 vines in Los Angeles.

Jean Louis Vignes (1779-1862), a Frenchman from Bordeaux, started a commercial vineyard near the present Union Station in Los Angeles a few years later and by 1833 was producing what seems to have been the best wine in California up to that time.



Mechanical crusher delicately separates the grapes from their stems.
California Wine Growers



A worker gingerly rolls a barrel of wine through the cool, damp tunnel of the winery. Joe Munroe - Wine Institute

European vines were imported by Vignes in the early 1830's, but the great change from the Mission to a wide variety of the finest grapes obtainable in the best viticultural districts of Europe took place nearly thirty years later, and was due largely to the efforts of Ágoston Haraszthy de Mokcsa (1812?-69).

Haraszthy, who fled his native Hungary in 1840 for political reasons, settled in San Diego in 1849, where he planted several importations, possibly including the Zinfandel, believed to be of Hungarian origin, but never definitely identified. Later this pioneer moved further north, settling at last in Sonoma.

In 1861 Haraszthy was sent abroad by the governor of California to select the widest possible variety of cuttings for experimentation. He returned with more than 100,000 cuttings, including about 300 varieties.

The real gold rush in California is often described as the great expansion of the wine industry that followed the maturing of the grapevines Haraszthy brought back from Europe. Many of the men who had come to the West in search of gold were winemakers from Europe, and these men and their descendants played a major part in the wine trade.

More than 125 principal varieties of *V. vinifera*

are grown commercially on the 485,000 California acres devoted to vineyards. This viticultural area includes thirty-six of the fifty-eight counties, extending from the Mexican border almost to the Oregon line.

As unsound and inferior wines began to be marketed, with the repeal of Prohibition (q.v.), regulations setting up quality standards were established by the Federal and some State governments.

United States Wine Industry. Twenty-eight States have adopted Federal standards or have enacted even more stringent regulations as to the labeling of wines. The standards set by California are known as the highest in the world. Under these strict rulings the wines of America have become known for their excellence the world over and have been awarded numerous medals at international expositions.

Wines grown in California, New York, Ohio, and other viticultural areas of the U.S. are in no sense imitations of foreign wines. They are individual and owe their characteristics to the soil, climate, rainfall, and other natural factors, as well as to the painstaking labor and watchfulness that attend every stage of their growth.

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More than seventy well-recognized wines are produced in the U.S. These include such familiar generic types as Burgundy, claret, port, Rhine wine, sherry, sauterne, Chablis, and champagne, as well as such varietal types as Barbera, Cabernet, muscatel, Riesling, Pinot Noir, Gamay, Chardonnay, Pinot Blanc, Sémillon, Sauvignon Blanc, and Zinfandel. In addition, many excellent wines are labeled simply white table wine, sparkling wine, or the like, the name of the maker or the trademark further identifying the individual product.

The wine industry in the U.S. produced about 479,000,000 gal. annually in the mid-1970's.

FOREIGN WINES

The production of wine is one of the leading industries of France, seventy-eight of the ninety-five departments producing it in large quantities.

French Wines. Until 1875 France easily led the world, but in the following years its vineyards were devastated by the phylloxera (q.v.), which reduced the acreage between 1875 and 1887 from 5,550,000 acres to 3,722,000, and the output of wine from 1,840,000,000 gal. to 535,000,000. The vineyards were restored after 1887 by grafting onto resistant American rootstocks, and the industry again flourished. The best-known wines made in France are Bordeaux, Burgundy, and champagne. The wines produced in the region of the Gironde, in and near the district of Bordelais, are commonly called Bordeaux, and include a large number of wines with somewhat widely varying characteristics. Among the grapes employed in the production of Bordeaux are the Cabernet, Petit Verdot, Merlot, Malbec, and Carmenère for red wines, and Sauvignon, Sémillon, Muscadelle, and Melon Blanc for white. Many light wines are made in this region; however, the light wines are usually blended with those having a higher percentage of alcohol before being placed on the market.

BORDEAUX. The Bordeaux viticultural region is divided into five main districts, namely Médoc, Saint Emilion, and Pomerol (which produce red wines); Sauternes and Graves (which produce mostly white wines); and a number of lesser districts. In some districts, principally Médoc and Sauternes, the wines are graded according to their supposed relative merits. The first classification of the Médoc wines was made in the 18th century, and has not been revised since 1855, when six groups were made, the first five called classified growths, and originally valued in the order of their number. This classification is rigorously retained, and it is difficult for a wine to be promoted into a higher grade even

though it may develop such a reputation that it will demand a higher price than many in the grades above it.

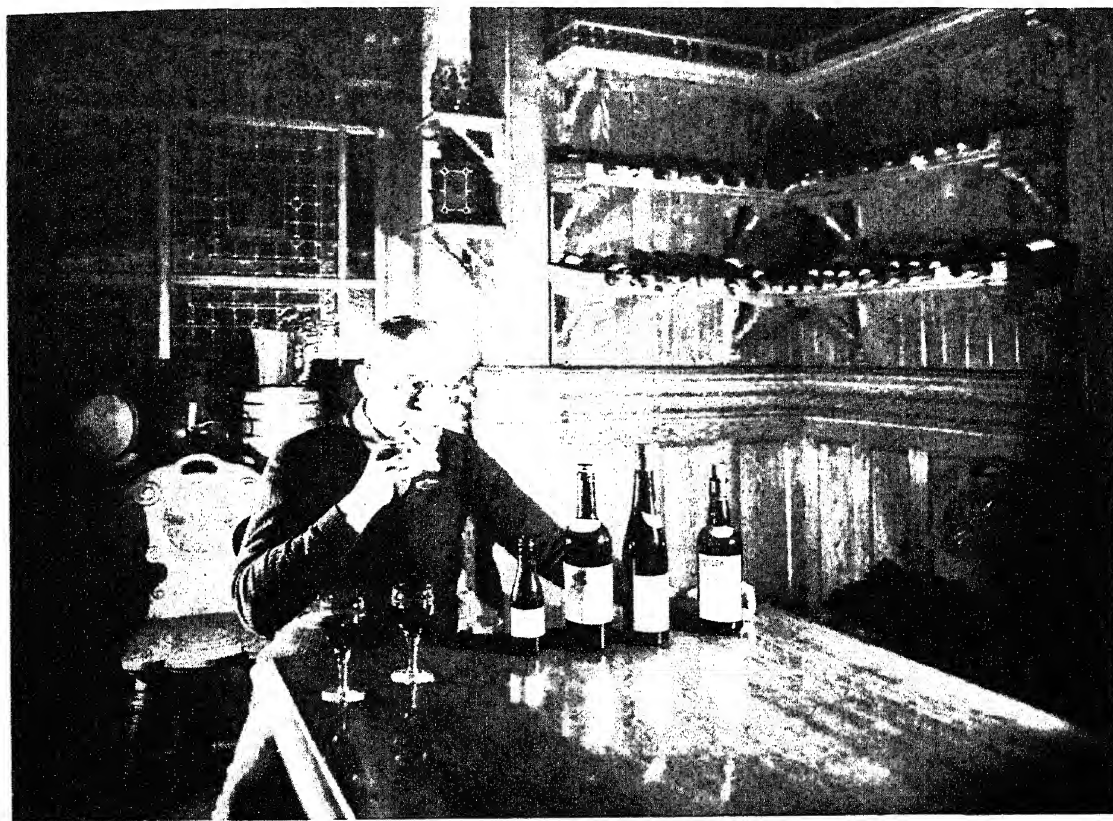
Each of the Gironde districts produces wines distinctly different from those of the other districts, but this distinction is not commonly understood, and the great majority of the wines of the Gironde region are sold simply as Bordeaux. **JURA.** Jura Department in eastern France near Switzerland, produces red, white, rosé, and sparkling wines. Among the best wines of this region are the red, white, and rosé wines of the Arbois district and the unusual light, sherrylike wines of Château-Chalon.

SAUTERNES. The white wines made in the Sauternes district of the Bordeaux region are light, sweet wines made from Sémillon, Sauvignon Blanc, and Muscadelle grapes, which develop a high sugar content from being left long on the vine. The rich, sweet-tasting, highly perfumed wines of the Sauternes district differ greatly from the other wines of Bordeaux.

BURGUNDY. The wines of Burgundy, which once ranked highest, are still held in high estimation by connoisseurs. Burgundy is rich in flavor, smooth, velvety, and when aged has a peculiar delicate aroma not present in the new wine. It has a medium content of alcohol, acid, and solids, and is full bodied and ruby red in color. The vineyards, growing Pinots, Gamay, and Chardonnay grapes, are located about halfway up the hillsides (800 to 1000 ft. high) in the Côte-d'Or between Dijon and Châlons. Other well-known regions of Burgundy are Chablis, which produces only white wines, and Beaujolais and Mâcon, which produce red and some white wines.

CHAMPAGNE. Champagne is the name given to a famous sparkling wine of French production. It derives its name from the ancient province of Champagne, where it was first produced. These wines, by French law, must be made from specific grapes, must be made sparkling by a second fermentation in the bottle, and must be approved by the local wine-tasting committee before they may be called champagne.

Notwithstanding years of painstaking research, the exact date or the approximate period when champagne first made its appearance is not known. The most ancient references to it occur in poems printed in 1711 and 1712 but its existence before that date is certain. Its production is today an industry of great importance. The sparkle of champagne is developed by a second fermentation either in the bottle or in a larger container. The carbon dioxide formed by the second fermentation is prevented from es-



Finished California wine is sipped during final test by an expert wine taster. The wines are examined for their appearance and bouquet as well as for their flavor.

Wine Institute

caping, and thus it builds up a strong pressure, sometimes as much as five or six atmospheres.

The production of champagne demands the highest degree of skill and care. In one traditional method the grapes are cut from the vines with scissors, the defective berries being removed; the fruit is carried to the press room with as little bruising as feasible and pressed quickly to avoid the extraction of an excess of tannin and coloring matter. After vigorous fermentation subsides the wine is racked into barrels, blended for the desired flavor, and removed to a cold cellar, where it is racked again in December. After the wine is allowed to age it is bottled, sugar and yeast are added, and the bottle is corked. The bottles are placed neck downward in an inclined position so that the sediment drifts down to the cork. When the wine clears, the cork is drawn, the sediment, dexterously removed, a small quantity of sweetened and flavored liquor is added, and the bottle is recorked quickly.

In the bulk process the second fermentation occurs in a large stainless-steel container. After the sediment settles, the wine is drawn off and bottled under pressure.

Austrian Wines. Austrian wines are little known in international commerce. No distinct type can be described, because the various parts of Austria produce widely different varieties. Many Austrian vineyards are fortunately located, and excellent wine may be produced by careful and efficient methods of production. The grapes are usually varieties native to the surrounding countries, especially Germany, Hungary, and Italy, and few characteristic local varieties are grown.

Italian Wines. Italy ranks next to France in the production of wine. The vine grows profusely in all parts of Italy, and the soil, climate, methods of grape culture, and grape varieties are so varied that wines with many different characteristics are produced. Although some of the wines are named for the grapes used in their production, others are given the name of the locality in which the grapes are grown. An example is Barolo, made from Nebbiolo grapes grown near the village of Barolo, in Piedmont. Barolo is considered by some to be the finest red wine of

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Italy. Such wines as Asti Spumante, produced in Asti, the center of the Muscat grape-growing district, are among the most famous Italian wines. Equally or perhaps better known is the district of Chianti in Tuscany; the wines of that district are often bottled in characteristic straw-covered flasks.

In addition to red wines, Italy produces some white wines, those of the Orvieto district being noteworthy, as is Lacrima Christi, produced in Campania. The southern part of Italy, including Sicily and other islands, produces sweet dessert wines, including Marsala, Malvasia, and muscatel.

Portuguese Wines. The soil and climate of Portugal are especially favorable to the grape, and some of the wines, which include red and white, sweet and dry, are among the most famous in the world. Port, made in the mountains near Oporto, is said to have been first exported in 1678. By 1750 annual exports reputedly totaled 2,000,000 gal. Grapes were introduced into the island of Madeira early in the 15th century,

The filled wine bottle is held over a bright light, often still a candle in even the most modern wineries, to test if clouding or sedimentation has occurred.

UPI



and since that time Madeira vintages have been in great demand. A light, sweet, aromatic Madeira wine called Malmsey from Monemvasia, an island in the Greek archipelago, is made from fully ripe grapes partially dried on the vines and is produced in the Azores, the Canaries, Sardinia, and Sicily, as well as Madeira.

Spanish Wines. The favorable soil and climate have made viticulture the most important agricultural industry of Spain, an industry which has repeatedly received governmental encouragement. The wines are high in alcohol, color, and aroma, and have been extensively used for blending with French wines, especially of the Gironde district, the red wines of Tarragona and La Rioja being favorites for this purpose.

SHERRY. Spain leads the world in the production of sherry, an appetizer wine ranging from dry to sweet. Spanish sherry is made in the southern part of the country between Port Saint-Mary (Puerto de Santa Maria) and Jerez, from which it is named. Some Spanish sherries contain only 14 or 15 percent of alcohol; others may have as much as 18 percent or more of alcohol. The sherry wines of Spain and of some other countries are produced by a mild secondary fermentation with flor yeast, sometimes in an open courtyard in the heat of sun, after which it is aged by the so-called Solera system. In the latter process, casks of wines of different ages are arranged usually in three tiers, the oldest wine being placed in the lowest tier. When fully aged, the wine in the lowest tier is partially drawn off and the casks are refilled from the tiers above. The casks in the second tier, containing the next-oldest wine, are then refilled from the top tier.

Two basic types of Spanish sherry exist, namely Fino, very pale and very dry, and Oloroso, rich, golden, and sweet.

The principal grape varieties for sherry are mainly the Palomino, the Mantúo Castellano, the Mantúo de Pila, and the Pedro Ximénez, which is used for making very sweet wines and for the so-called blending sherries.

The bulk of the annual production of wine is table wine, most of which is consumed locally during the year of the vintage. The La Rioja region produces both red and white table wines made from French grape varieties. Montilla is a wine similar to sherry made in the Montilla Mts. near Córdoba. Three Catalan wines which should be noted are a red wine, similar to port, produced in Tarragona; a dessert wine, Moscatel de Málaga, produced in Sitges and popular in Spain and Latin America; and a light, white, beverage wine produced in Alella.

German Wines. The valleys of the Rhine and the Moselle in eastern Germany, long famous for their wines, mark the northern limit of successful viticulture, but probably they suffer from unfavorable climatic conditions, especially cold and wet, more frequently than any other region. In favorable seasons the wines are of exceptionally fine flavor and delicate aroma. The Rhine valley is the most important wine district of Germany; north of Koblenz little wine is made; between Koblenz and Assmannshausen the wine produced is inferior. From the vicinity of Assmannshausen to that of Mainz on the north bank of the river are many of the most famous wine-producing localities, and in the neighborhood of Hochheim is produced the so-called hock, under which name English usage often includes all Rhine wine. The best-known Rhine wine is Liebfraumilch. A slightly sweet, full-bodied white wine, this type usually is a blend of wines produced in the Rheinhessen district of the Rhine region.

The valleys of the Moselle and the Saar, especially in Lorraine, produce large quantities of high-grade wine. In Württemberg much low-grade wine is made. Characteristically German wine is white, but red wines are produced in some localities.

The list of varieties of grapes employed is smaller than that of France, and includes Riesling (most widely grown), Traminer, Müller-Thurgau, Burger, Sylvaner, Rüländer, Affenthaler, Arbst, Kleinberber, Orléans, and Elbling.

Greek Wines. Since early historical times the hillsides and valleys of Greece have been famous for their wines. The wines of Santorin are acknowledged as the best. Other celebrated Greek wines are the Malvoisies or the Kephissia of Attica, a red wine of Zante, and the so-called Tokays, which are largely exported from Pátrai. The most popular and widely distributed wine is Mavrodaphne, a sweet red dessert wine made from the grape of the same name. Others in good repute are Thera, Caliste, and Saint Elie. A favorite among the Greeks is retsina, which refers to any white or rosé wine that has been treated with pine resin.

Hungarian Wines. Among the most prized Hungarian wines are Tokay and Egri Bikavér, produced from Hungarian varieties of grapes. German and Italian varieties are also grown. Among the celebrated vineyards are those of Erlau, Tokay, Bakator, Erdöd, Somlyó, and Ménes; the Hegyalja Mt. and the valleys of Samos and Bodrog in the north; and Rust, Alsó-Fehér, the Banat, and the Wojwodina in the south.

Swiss Wines. The wines of Switzerland are mostly dry, white, light-bodied, and sometimes slightly sparkling. Most widely known names are Dézaley, and Neuchâtel for white wines, and Dôle for red. Grapevines include Chasselas, Pinot Noir, Gamay, Müller-Thurgau, Riesling, Sylvaner, Klevner, and Nostrano.

Other Wines. Among other major wine-producing areas are Africa, Australia, South America, and the Soviet Union. The formerly French north African vineyards of Algeria, Morocco, and Tunisia were once the source of vast amounts of ordinary wine with some excellent exceptions, but have become less important. The Republic of South Africa and Australia produce mostly dessert wines, but also table wines, some of which have won wide acceptance on the world market. South America has a long history of wine growing. Its best wines come from Chile, where the vineyards were established by immigrants from the Bordeaux region of France. In the mid-1970's the Soviet Union produced about 839,500,000 gal. of wine annually, much of it in the Caucasus, where the wine-bearing plant apparently originated. Sparkling wines are prevalent, but all types of wine are produced.

WINFIELD, city in Kansas, and county seat of Cowley Co. on the Walnut R., about 36 miles s.e. of Wichita. The city is a shipping point in the agricultural area of the Arkansas River. The city has oil and gas fields in the vicinity. The Snyder Memorial Research Foundation for research in biochemistry is situated here. It is the site of Southwestern College (1885) and Saint John's College (1893). Founded in 1870, Winfield was incorporated as a city in 1873. Pop. (1960) 11,117; (1970) 11,405.

WINFRID, Saint. See BONIFACE, SAINT.

WING, in biology, one of paired movable appendages by means of which flight may be achieved. Birds, bats, and insects propel themselves through the air by flapping their wings. The extinct reptile pterodactyl (q.v.) also flew in this manner. This type of flight, sometimes called true flight, is distinguished from gliding flight, in which the wings are outstretched to sustain flight with little or no motion. Gliding flight is found among certain fish, mammals, amphibians, and reptiles, and is also employed by various birds, including hawks, vultures, and gulls.

Among vertebrates, the wing is homologous to the forelimb or arm, and assumes many different shapes. The wings of a bird (q.v.) are covered with feathers, and form a support and axis to which are attached the muscles that move it. Those of a bat (q.v.) are merely membranes



The outstretched wings of the ring-billed gull enable it to sustain gliding flight with little or no motion.

Allan D. Cruickshank - National Audubon Society

which are spread across modified fingers, and are attached to the side of the body to form a patagium. The wings of the so-called flying animals, such as flying foxes, flying lizards, and the flying squirrel (q.v.), are merely expansions of the skin along the sides of the body. They are not organs of flight, but serve only to assist the animals in jumping from tree to tree, or from a tree to the ground. Among invertebrates, true wings are found only in insects, and consist usually of two layers of skin supported on hollow tubes, or nervures. They are often covered with minute scales, and always communicate with the respiratory system; see INSECT. In the flying fish (q.v.), the flightlike movements are accomplished by means of large pectoral fins which are modified to serve as wings.

Wings are used for many purposes other than for flight. They assist many water birds to dive and swim by underwater motions analogous to flying; they shield eggs or tender fledglings from rain and hot sun during hatching and brooding; and they serve as weapons for such animals as the turkey and spurwinged goose. In birds such as the snipe and hummingbird (qq.v.), and in many insects, the wings are modified so as to make a distinctly audible noise when in flight. Wings are also utilized by many animals as a means of emotional expression, especially during the mating season. In such cases they are fluttered, elevated, spread, beaten against the body, or clapped together over the back to produce drumming or crackling sounds expressing excitement or serving as signals or challenges.

For wing in airplane, see AERODYNAMICS; AIRPLANE: *Airplane Structure*; FLIGHT, THEORY OF.

WINGATE'S RAIDERS, name given during World War II to a corps of British, Burmese, and Gurkha commandoes, commanded by British Major General Orde Charles Wingate (1903-44), who fought behind Japanese lines in Burma. General Wingate organized his effective force in 1941 at the request of his British superiors, and their daring guerrilla strikes dealt a significant blow to Japanese advancement in southeastern Asia. Also known as the Chindits, after dragon statues fronting Burmese temples, the raiders demolished bridges, military installations, ammunition dumps, and railway lines, and by 1944 had infiltrated deep into Japanese-held territory, where they relayed intelligence to the British Royal Air Force. They played a key role in the Allied counteroffensive and eventual recovery of Burma and helped prevent a Japanese invasion of India. The raiders continued their operations after General Wingate was killed in an airplane crash in April, 1944. See COMMANDO; GUERRILLAS; STILWELL, JOSEPH WARREN. **WINGED VICTORY**. See NIKE.

WINKELRIED, Arnold von (d. 1386), Swiss patriot. According to tradition, he made possible the Swiss victory over the Austrians at Sempach (q.v.), in Switzerland, on July 9, 1386. He is said to have seized all the Austrian spears he could reach and to have buried them in his own breast, thus creating a gap in the Austrian line through which his countrymen could rush. The degree of truth in the legend is disputed among authorities. Nevertheless, Winkelried remains a national hero in Switzerland and a monument in his honor was erected in 1886 on the site of the battlefield at Sempach. See SWITZERLAND: *History*.

WINNEBAGO, North American Indian tribe formerly residing in the Green Bay area of the

present-day State of Wisconsin. The Winnebago speak a Siouan (q.v.) dialect and now live on reservations in Wisconsin and Nebraska.

WINNEBAGO, largest lake of Wisconsin, in Calumet, Fond du Lac, and Winnebago counties, 48 km (30 mi.) long, with a maximum breadth of 16 km (10 mi.). It constitutes part of the course of the Fox R., which enters it at Oshkosh and issues from its N. extremity. The lake covers 557 sq.km (215 sq.mi.).

WINNER, Septimus (1827–1902), American composer and music teacher, born in Philadelphia, Pa. He taught the technique and art of various musical instruments and wrote some 200 instruction manuals as well as many hundreds of transcriptions for piano and violin. His most successful composition was "Listen to the Mocking Bird" (1855), which achieved a sale of 20,000,000 copies within twenty years.

WINNETKA, village of Illinois, in Cook Co., about 18 miles N. of central Chicago. Some manufacturing is done here. Established in 1854, Winnetka was incorporated as a village in 1869. Pop. (1960) 13,368; (1970) 14,131.

WINNIPEG, city and provincial capital, s. Manitoba, Canada, at the confluence of the Assiniboine and Red rivers, about 100 km (60 mi.) N. of the United States boundary. Served by major railroads and highways and by a busy international airport, the city is the trade center for a wide grain- and livestock-producing region and for the mining districts of N. Manitoba. It has large grain elevators and vast stockyards and rail yards. Winnipeg also has many manufacturing industries, which have benefited from the availability of inexpensive hydroelectricity generated by facilities on the Winnipeg R. Manufactures of the city include food products, notably processed grain, dairy goods, and meat; forest products; motor vehicles and farm machinery; railroad rolling stock; and clothing.

Winnipeg is a cosmopolitan city, with a varied cultural life. It is the site of the University of Winnipeg (1871), the University of Manitoba (1877), the Manitoba Museum of Man and Nature, and the Winnipeg Art Gallery. The city also supports the Winnipeg Symphony Orchestra and the Royal Winnipeg Ballet. Other points of interest include the Manitoba Legislative Building, the remains of Fort Garry, and Old Saint Andrew's Church (1845–49).

History. The first white settlement on the site of modern Winnipeg was established in 1738 by the French-Canadian explorer Pierre Gaultier de Varennes, Sieur de La Vérendrye (q.v.), who built Fort Rouge there. The structure was subsequently abandoned, but in 1804 the North West

Company built Fort Gibraltar nearby, and in 1812 a group of Scots and Irish immigrants settled in the area. In 1821 the Hudson's Bay Company enlarged Fort Gibraltar and renamed it Fort Garry. The community developed slowly as a fur-trading and distribution center. In 1870 it was named Winnipeg and became the capital of the new province of Manitoba; in 1873 Winnipeg was incorporated as a city. The economic growth of the city was spurred by the opening of a rail link with Saint Paul, Minn., in 1878, and by the coming of the Canadian Pacific Railway, in 1881. Many European immigrants settled in Winnipeg in the early 1900's, and by 1914 the city had about 203,000 inhabitants. After 1940 Winnipeg's industrial plant was increased substantially, and the city's economy also profited from the growth of N. Manitoba as a mining region. In 1972 Winnipeg annexed several of the adjacent communities, including Saint Boniface and Saint James-Assiniboia, and thereby became Canada's third most populous city. Pop. (1976) 560,874; Census Metropolitan Area 578,217.

WINNIPEG, LAKE, large lake of s. Manitoba, Canada, near the city of Winnipeg. A remnant of prehistoric Lake Agassiz, it is 425 km (264 mi.) long and has an area of 24,390 sq.km (9417 sq.mi.). The comparatively shallow lake is fed by several rivers, including the Red, Saskatchewan, and Winnipeg, and it is drained by the Nelson R., which flows to Hudson Bay. Among the large islands in the lake are Reindeer Island and Hekla Island. The w. lakeshore is well forested. Lake Winnipeg has important commercial fisheries, and its s. shore is a summer resort area. The lake was discovered in 1733 by the French-Canadian explorer Jean-Baptiste de La Vérendrye (1713–36).

WINNIPEGOSIS, LAKE, lake of w. Manitoba, Canada. It is about 200 km (125 mi.) long and has an area of 5374 sq.km (2075 sq.mi.). The lake drains s.e. into Lake Manitoba and then into Lake Winnipeg. Lake Winnipegosis has large commercial fisheries.

WINNIPESAUKEE, LAKE, formerly WINNEPESAUKEE, largest lake of New Hampshire, in Carroll and Belknap counties near the s. extremity of the White Mts. It is 143 m (470 ft.) above sea level, has a maximum depth of 91 m (300 ft.), is 40 km (25 mi.) long, 19 km (12 mi.) wide, and covers 184 sq.km (71 sq.mi.). The Winnepesaukee R., one of the headwaters of the Merrimack R., is its outlet. Noted for its beauty, the lake contains more than 300 islands and is surrounded by wooded hills. It is the center of a popular resort region.

WINONA

WINONA, city in Minnesota, and county seat of Winona Co., on the Mississippi R., 40 miles E. of Rochester. On three sides of the city picturesque limestone bluffs tower 500 to 600 ft. above the river. Winona is a shipping and industrial center for the surrounding agricultural and limestone-quarrying region. The principal industrial establishments in the city include railroad repair shops and factories producing automobile accessories. Saint Mary's College (1913) and the College of Saint Teresa (1910), respectively Roman Catholic colleges for men and women, and a State teachers' college are located in the city. Winona was founded in 1851 and chartered as a city in 1857. Pop. (1960) 24,895; (1970) 26,438.

WINSLOW, name of a family of English colonizers in America. The following are its most important members.

Edward Winslow (1595–1655), one of the Pilgrim Fathers (q.v.), born in Droitwich, Worcestershire, England. He came to America in 1620 on the *Mayflower* (q.v.) and was a founder of Plymouth Colony (q.v.), in the present-day State of Massachusetts. In 1621 he negotiated a treaty of friendship with the local Wampanoag Indians (q.v.), and he was one of the first settlers to explore the New England coast and establish trading relations with the Indian tribes of that area. Between 1624 and 1646 he served on the governor's council of Plymouth Colony, and he was elected governor in 1633, 1636, and 1644. In 1635, while visiting England as an agent for the colony, he was imprisoned for several months by the archbishop of Canterbury, William Laud (q.v.), on charges that he had committed offenses against the Anglican Church. Winslow returned to England during the Great Rebellion (q.v.), and after the triumph of the Puritan cause he served the Commonwealth government of the English lord protector Oliver Cromwell (see under CROMWELL). In 1655 Cromwell sent him on a campaign against the Spanish West Indies; he died during the return trip to England. Among his writings are several works valued by historians of the New England colonies, notably *Good Newes from New England* (1625), *Hyprocrisie Unmasked* (1646), and *Glorious Progress of the Gospel Among the Indians* (1649).

Josiah Winslow (1629?–80), Puritan statesman and soldier, son of the preceding, born in Plymouth Colony, and educated at Harvard College (now Harvard University). He served on the governor's council of Plymouth Colony from 1657 until 1673, when he was elected governor. The first native-born governor of a New England colony, he held that post until his death. In

1675–76, during King Philip's War, Winslow was commander in chief of the colonial army; see PHILIP, sachem of the Wampanoag. See MASSACHUSETTS: History.

WINSLOW, John Ancrum (1811–73), American naval officer, born in Wilmington, N.C. He entered the United States Navy as a midshipman in 1827, attained the rank of lieutenant in 1839, and became a commander in 1855. During the first year of the American Civil War he served under Capt. Andrew Hull Foote (q.v.), of the Union navy, in operations on the Mississippi R.; see CIVIL WAR, THE AMERICAN. Winslow was promoted to the rank of captain in July, 1862, and given command of the armored cruiser U.S.S. *Kearsarge*, with the special duty of tracking down Confederate raiders in European waters. In June, 1864, he learned that the famous Confederate privateer *Alabama*, commanded by Captain Raphael Semmes (q.v.), was at Cherbourg, France. Proceeding to that port, he engaged the *Alabama* on June 19, 1864, and forced her to surrender; see ALABAMA CLAIMS. For his victory Winslow received a Congressional vote of thanks and promotion to commodore. He attained the rank of rear admiral in 1870 and commanded the squadron of the U.S. Navy in the Pacific Ocean from 1870 until 1872.

WINSOR, Justin (1831–97), American librarian and historian, born in Boston, Mass., and educated at Harvard University and in Germany at the University of Heidelberg. He began his career as a journalist. In 1866 he was made a trustee of the Boston Public Library and in 1868 he became superintendent of that institution. In 1877 he was appointed librarian at Harvard University, a position he held for the remainder of his life. He was a founder in 1876 of the *Library Journal* and of the American Library Association and president of the association from 1876 to 1885. Winsor edited the *Memorial History of Boston* (1880–82) and *Narrative and Critical History of America* (8 vol., 1884–89). His writings include *The Reader's Handbook of the American Revolution* (1879), *Christopher Columbus* (1891), *The Mississippi Basin* (1895), and *The Westward Movement* (1897).

WINSTON-SALEM, city in North Carolina, and county seat of Forsyth Co., 68 miles N.E. of Charlotte. It is one of the largest tobacco processing centers in the world. Other important industries include the manufacture of hosiery, textiles, underwear, electronic equipment, and furniture. Among the points of interest is Old Salem, a restored, 18th-century Moravian settlement. Noteworthy structures in Old Salem are Salem Tavern (1784), Wachovia Museum (1794),

and the Home Moravian Church (1800). The educational institutions of the city include Salem College, founded (1772) as Salem Girls School, Wake Forest University (1833), and Winston-Salem State University (1892).

Salem was founded in 1766 by a group of Moravians from Pennsylvania; see MORAVIAN CHURCH. Winston was established in 1849 as the county seat of the newly created Forsyth County. In 1913 the two communities were merged as Winston-Salem. Pop. (1970) 132,913. **WINTERBERRY**, common name applied to various North American species of holly (q.v.), belonging to the genus *Ilex*. The common winterberry, *I. verticillata*, or black alder, is a deciduous shrub, with spreading branches, from 6 to 12 ft. in height. It is found in eastern North America as far west as Wisconsin. Great quantities of brilliant red berries appear on the winterberry in October. The twigs are popular as vase ornaments because the berries retain their brightness for several months. The smooth winterberry, *I. laevigata*, is a low shrub similar to the black alder.

WINTERGREEN, or CHECKERBERRY or TEABERRY, common names applied to an evergreen shrub, *Gaultheria procumbens*, in the Heath family, Ericaceae. The shrub, native to eastern North America, bears solitary white flowers and scarlet berrylike fruit. The leaves yield a volatile oil, called wintergreen oil, which is used as a flavoring agent and in medicine as a local antiseptic and an ingredient of liniments. Wintergreen oil is now produced synthetically as methyl salicylate; see SALICYLIC ACID.

WINTER HAVEN, city of Florida, in Polk Co., about 15 miles E. of Lakeland. A marketing center and a resort area, the city also has some manufacturing. The most important industry is the canning of citrus fruits. Cypress Gardens is nearby. The American Boating Association holds its annual races at Winter Haven. Pop. (1960) 16,277; (1970) 16,136.

WINTER OLYMPICS, popular designation for the Olympic Winter Games, the winter sports competitions forming a division of the Olympic Games. Speed and figure skating, skiing, ice hockey, luge, or tobogganing, biathlon, or skiing and shooting, and bobsledding are the sports. The contests usually take place in the February preceding the regular, or summer, Games. Ice-skating competitions were included in the Olympic Games of 1908 and 1920. The first full-scale Winter Olympics was staged in 1924 at Chamonix, France; the contests have been held regularly since that time. Norwegian athletes won the unofficial national title in 1924. In the

1928 games, in Saint-Moritz, Switzerland, the Norwegians triumphed again. The United States athletes won the unofficial title in the 1932 Winter Olympics in Lake Placid, N.Y. In the 1936 games in Garmisch-Partenkirchen, Germany, the Norwegians were once again victorious. The Games were resumed after World War II, and the unofficial title was won by Sweden in 1948 in Saint-Moritz; by Norway in 1952 in Oslo, and in 1968 in Grenoble, France; by the Soviet Union in 1956 in Cortina d'Ampezzo, Italy, in 1960 at Squaw Valley, Calif., in 1964 in Innsbruck, Austria, in 1972 in Sapporo, Japan, and in 1976 in Innsbruck; and by East Germany in 1980 in Lake Placid.

See OLYMPIC GAMES and separate articles on the sports mentioned above.

WINTER PARK, city of Florida, in Orange Co., about 6 miles N. of Orlando. Primarily residential, the city is popular as a winter resort. Winter Park is in the center of a citrus fruit area in which the Temple orange was developed. In the city is Rollins College, founded in 1885. Established in the 1850's, Winter Park was incorporated in 1887. Pop. (1960) 17,162; (1970) 21,895.

WINTERTHUR, city of Switzerland, in Zürich Canton, 12 miles N.E. of Zürich. It is an important railroad center and is noted for the manufacture of locomotives, diesel engines, and textiles. Among the points of interest are the town hall, a 16th-century church, and the museum and art gallery. It became a Hapsburg possession in 1264 and was sold to Zürich Canton in 1467. Pop. (1971 est.) 92,700.

WINTHROP, town of Massachusetts, in Suffolk County, on Boston Harbor, 5 miles N.E. of Boston. The town is on a peninsula in Massachusetts Bay, and is a residential suburb of Boston. It was settled in 1635 and incorporated in 1852. Pop. (1960) 20,303; (1970) 20,335.

WINTHROP, name of a colonial American family of English origin. The following are its most important members.

John Winthrop (1588–1649), born in Edwardstone, West Suffolk, England, educated at the University of Cambridge, and trained for the law at Gray's Inn, in London. In 1623 he was appointed to the lucrative position of attorney in the court of wards and liveries, but he lost that post in 1629, probably because of his Puritan beliefs and associations; see PURITANS. Later in 1629 the Massachusetts Bay Company (q.v.) in London selected him to govern their colony in New England. With a company of some 1800 Puritan settlers, Winthrop sailed from Yarmouth in March, 1630, and landed at Salem, Mass., on June 12. Shortly thereafter he settled in the

WIRE

Shawmut Peninsula community, later renamed Boston; see BOSTON: *History*.

Winthrop was elected governor of Massachusetts Bay Colony twelve times between 1630 and 1649. Believing that the colony could be more effectively governed by a few learned and pious leaders, he opposed an unlimited democracy. For this reason, while serving as deputy governor under Sir Henry Vane, he considered that the doctrines of the religious reformer Anne Hutchinson (qq.v.) threatened to subvert moral law. Winthrop presided over the court that found Anne Hutchinson guilty and banished her from the colony. In 1643 he helped to organize the New England Confederation (q.v.), which he served as the first president. Winthrop was one of the most distinguished and capable figures of colonial New England. His administrative ability and wisdom were in large part responsible for the early prosperity of the Massachusetts Bay Colony. His journals were published in 1825–26 as *History of New England 1630–1649*.

See MASSACHUSETTS: *History*.

John Winthrop (1606–76), son of the preceding, born in Groton, West Suffolk, England, and educated at Trinity College, Dublin. He joined his father in Massachusetts Bay Colony in 1631, and in 1646 he founded the town of New London, in the Connecticut colony. From 1657 until his death Winthrop served almost without interruption as governor of the Connecticut colony.

See CONNECTICUT: *History*.

WIRE, elongated, flexible filament made of ductile metal and produced in various sizes, or diameters, designated by gauge numbers; see METALS. The metals used for wire production are mainly copper, aluminum, steel, brass, iron, gold, silver, and platinum. For solid or single-piece wire the size or gauge number relates to the cross section of the wire perpendicular to its longitudinal axis. Gauge numbers of stranded wire refer to the total cross section of the constituent wires. Various gauges are used in the United States for different kinds of wire. The standard scale for copper and aluminum wire is the so-called American, or Brown and Sharpe, wire gauge, which ranges from gauge no. 0000, with a diameter of 0.460 in., to gauge no. 40, with a diameter of 0.00314 in. For steel and iron wires, the standard is the U.S. steel-wire gauge, which ranges from no. 0000000 for 0.490 in. to no. 50 for 0.0044 in.

The modern process of producing wire consists essentially of drawing a metal rod through successively smaller conical holes in tungsten-carbide dies until the desired diameter is ob-

tained; see DIE. The dies for very fine wires are made of commercial diamonds rigidly set in metal disks. After a certain number of draws, depending on the type of metal, wire becomes hard and brittle and must be annealed by controlled heating and cooling to restore its ductility; see ANNEALING.

Uses. Wire has many different applications in modern technology and in household use, and the type of wire used depends upon the purpose for which it is employed. Telephone and telegraph (qq.v.) wires are usually made of copper, which has high electrical conductivity; see CONDUCTOR, ELECTRICAL. For high-tension electrical transmission lines, aluminum wire is employed because it is a good conductor, is less expensive, and lighter in weight than copper. Iron wire is used for electrical resistors; see RESISTANCE.

The springs used in upholstery and the strings for musical instruments are often made of steel wire; see SPRING. Steel is used also in the manufacture of wire cables for suspension bridges and for fencing requiring high tensile strength (q.v.). Very fine platinum wire is used in various scientific instruments and in such mechanisms as watch springs, and a fine wire is often used as a fuse (q.v.), an electrical safety device that melts and interrupts an overloaded electric circuit (q.v.). Wire is employed in the manufacture of numerous other products, including rope, netting, screens, wired glass, and jewelry. Many modern handicrafts and sculptures utilize wire as a material.

See also CABLE, ELECTRIC; ELECTRIC-POWER SYSTEMS; INSULATION.

WIRE RECORDER. See SOUND RECORDING.

WIRETAPPING, interception of telephonic or telegraphic communications by electronic listening or recording devices for purposes of espionage or surveillance. In the United States, wiretapping is prohibited by a 1968 Federal statute and the laws of some States. Wiretapping by law enforcement officers, however, is permitted under the Federal statute and the laws of some States, provided a court order has been obtained.

A Presidential commission in 1967 recommended that law enforcement authorities be permitted to engage in wiretapping to combat organized crime, and the Supreme Court of the United States (q.v.) indicated that wiretapping could be employed without violating the Fourth Amendment to the Constitution of the United States (q.v.). A major Supreme Court decision in 1937, however, imposed strict restrictions on the use by Federal officers of the information ob-

tained by such interception and forbade its use as evidence in court. In the first three years after the enactment of the 1968 statute, about 600 Federal wiretaps resulted in over 1500 arrests.

Although court-ordered wiretapping is now legal, wiretapping by the Federal government without a court order is not. The courts have sustained its use to obtain foreign intelligence information, but in 1971 the Supreme Court held in two different cases: (1) that domestic electronic surveillance of radical political groups without a court order violated the Fourth Amendment, and (2) that witnesses before a grand jury could refuse to answer questions arising out of information developed from unauthorized wiretaps.

Commercial or industrial espionage by rival manufacturers, although illegal, is sometimes carried out by wiretapping. See *ESPIONAGE. Commercial Espionage; Espionage Technology*

WISCONSIN, one of the East North Central States of the United States, bounded on the n. by Lake Superior and the upper peninsula of Michigan, on the e. by Green Bay and Lake Michigan, on the s. by Illinois, on the sw. by the Mississippi R., and on the w. by the Mississippi and Saint Croix rivers. Wisconsin measures about 300 mi. from N to S and about 295 mi. from E. to W

Area (26th State in rank)	56,154 sq. mi.
Land	54,464 sq. mi.
Inland water	1,690 sq. mi.
Population	(1970, 16th in rank) 4,417,933
	(1960, 15th in rank) 3,951,777
	(1950) 3,434,575
Altitude	581 ft. to 1953 ft.
Capital	Madison (1970) 173,258
Largest city	Milwaukee (1970) 717,372
Entered Union (30th State)	May 29, 1848
Nickname	The Badger State
Motto	Forward
Song	"On, Wisconsin!"
Tree	sugar maple
Flower	wood violet
Bird	robin

THE LAND

The surface of Wisconsin consists, for the most part, of rolling plains modified by ridges and hills. The Northern Highland district, in north-central Wisconsin, a dome-shaped, slightly dissected plain, contains the highest point in the State, Timms Hill (1953 ft.). Here also are the Gogebic Iron Range, a long, narrow ridge nearly 1800 ft. above sea level; and a number of parallel ridges of trap rock, isolated hills of quartzite, and glacial hills.

Other topographical features found in Wisconsin are the Lake Superior lowland, the central plain, the eastern ridges and lowlands, and the western uplands. The lowest point in the State (581 ft.) is on Lake Michigan. The mean elevation of Wisconsin is 1050 ft.

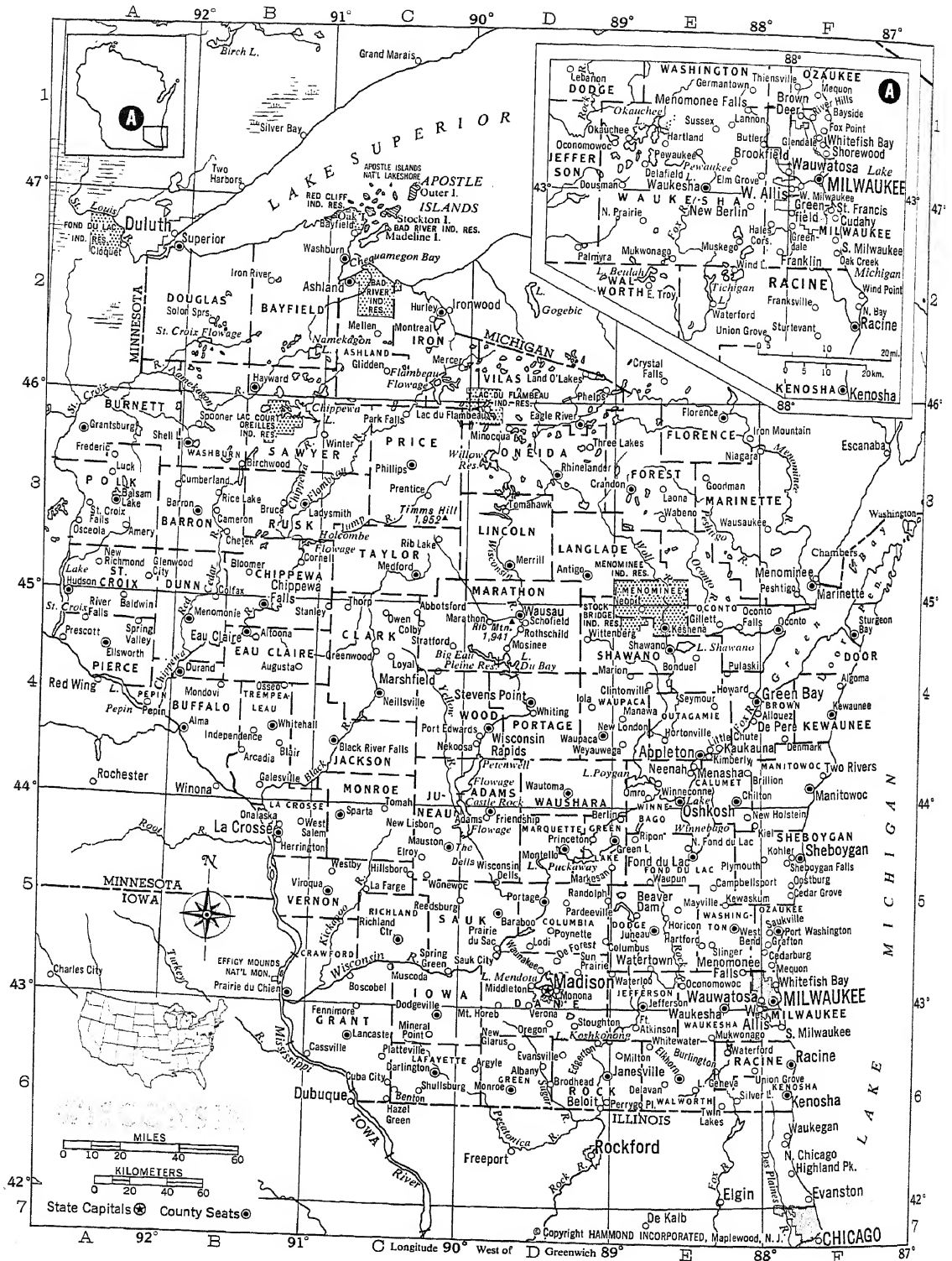
Rivers and Lakes. The Mississippi R. and its tributary, the St. Croix R., form most of the border of Wisconsin with Minnesota and Iowa. Other major rivers that flow into the Mississippi are the Wisconsin, Black, and Chippewa rivers. The Fox R., which rises in south-central Wisconsin and receives the Wolf R., flows through Lake Winnebago, the largest of the more than 8600 lakes in the State, and thence to Green Bay. The Menominee R. forms part of the border with Michigan and empties into Green Bay. Among the other large lakes in Wisconsin are Lakes Poygan, Mendota, and Koshkonong in the s., and Lake Tomahawk in the n. Artificial lakes include Lake Chippewa, Petenwell Flowage, Castle Rock Flowage, and Big Eau Pleine Reservoir on the Wisconsin R., and Flambeau Flowage on the Flambeau R.

Climate. Wisconsin has a typically continental climate, with some modification by Lakes Michigan and Superior. Winters are cold and snowy, and summers are warm. The highest temperature recorded in the State was 114° F. (at Wisconsin Dells); the lowest, -54° F. (at Danbury). Annual precipitation averages 30 to 34 in. in the w. uplands and n. highlands, declining to 28 to 30 in. over the rest of the State. Snowfall ranges from 30 in. in the extreme s. to more than 100 in. on the w. slope of the Gogebic Range in the n. The average annual number of days with measurable precipitation is 109 at La Crosse, 114 at Madison, and 119 at Green Bay and Milwaukee. Tornadoes average four per year.

Climate	La Crosse	Madison	Milwaukee
Normal temperatures (in ° F.)			
January maximum	25.0	25.4	27.3
January minimum	7.1	8.2	11.4
July maximum	83.0	81.4	80.4
July minimum	62.5	58.8	59.3
Annual	46.4	44.9	45.7
Normal precipitation (in inches)			
Wettest month	4.44	4.33	3.58
Driest month	.87	.95	1.13
Annual	29.08	30.25	29.07
Latest frost	May 1	April 26	April 20
Earliest frost	Oct 8	Oct 19	Oct 25
Mean number of days between latest and earliest frosts	161	177	188

Plants and Animals. The principal trees in Wisconsin forests are eastern hemlock, maples, American elm, American basswood, and yellow birch. Shrubs include juniper, chokecherry, and hazel. Wild flowers are abundant and include trillium, lotus, and forty-five species of native orchid. The better-known forms of wildlife native to the State are the white-tailed deer, black bear, beaver, muskrat, gray wolf, red fox, and mink. Game birds include the introduced pheasant, ruffed and ring-necked grouses, Can-

WISCONSIN



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○ County seat

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Flambeau (river)	B 3
Fox (river)	E 4
Green (bay)	F 4
Jump (river)	C 3
Kickapoo (river)	C 5
Koshkonong (lake)	D 6
Lac Court Oreilles Ind. Res.	B 3
Lac du Flambeau Ind. Res.	D 2
Mendota (lake)	D 5
Menominee (river)	F 3
Menominee Ind. Res.	E 4
Michigan (lake)	F 5
Mississippi (river)	B 6
Namekagon (lake)	C 2
Namekagon (river)	B 2
Oconto (river)	E 3
Okauchee (lake)	E 1
Pecatonica (river)	D 6
Pepin (lake)	A 4
Peshigo (river)	E 3
Pewaukee (lake)	E 1
Red Cedar (river)	B 4
Red Cliff Ind. Res.	B 2
Rib (mt.)	D 4
Rock (river)	E 5
Saint Croix (river)	A 3
Stockbridge Ind. Res.	D 4
Sugar (river)	D 6
Superior (lake)	C 1
Tichigan (lake)	E 2
Timms Hill (mt.)	C 3
Washington (isl.)	G 3
Winnabago (lake)	E 5
Wisconsin (river)	C 5
Wolf (river)	E 3
Yellow (river)	C 4

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ada geese, and various ducks. Trout, bass, pike, perch, catfish, sturgeon, muskellunge, bluegill, and buffalo fish occur in the State.

Parks, Forests, and Other Places of Interest.

The two national forests in Wisconsin comprise about 1,470,000 acres: Chequamegon National Forest, with headquarters at Park Falls, and Nicolet National Forest (Rhinelander). Apostle Islands National Lakeshore is on the S. shore of Lake Superior. Ice Age National Scientific Reserve is the first in that category in the U.S. The Saint Croix and Wolf River national scenic riverways are initial components of the Wild and Scenic River System. The numerous State forests include American Legion, near Rhinelander; Apostle Islands, in Lake Superior, near Bayfield; Black River, near Black River Falls; Brule River, near Superior; Flambeau River, near Fifiield; Kettle Moraine, in two sections, one near Plymouth and one near Whitewater; Northern Highland, near Rhinelander; and Point Beech, on Lake Michigan near Two Rivers. Notable among the many State parks is Wyalusing State Park, near Prairie du Chien, in which is the confluence of the Mississippi and Wisconsin rivers. Among natural features of the State are the Cave of the

Mounds, near Madison, containing interesting geological formations; and Wisconsin Dells, on the Wisconsin R., 7 mi. of cliffs and glens in the river canyon. Door County, on the peninsula near Green Bay, is cherry-growing country and contains Washington Island and picturesque fishing villages. Little Norway, a village near Madison, is modeled on a Norwegian valley hamlet.

Sports. The lakes and waterways of Wisconsin provide fine fishing. Among species found are black bass, walleye and northern pike, muskellunge, and brown, brook, lake, and rainbow trout. Game animals and birds hunted are white-tailed deer, black bear, snowshoe hare, cottontail rabbit, fox and gray squirrels, jackrabbit, ruffed grouse, ring-necked pheasant, and Hungarian partridge. Wisconsin has wintersport centers throughout the State, including fifty organized ski areas. Among the largest ski operations are Mt. La Crosse, near La Crosse; Mt. Telemark, at Cable; White Cap, at Hurley; and Rib Mountain, at Wausau.

THE PEOPLE

According to the 1970 decennial census, the population of Wisconsin was 4,417,933, an in-



The Johnson Wax building in Racine, designed by American architect Frank Lloyd Wright.

S. C. Johnson & Son Inc.



A rural village near one of the many lakes in northern Wisconsin.
Wisconsin Conservation Dept.

crease of 11.8 percent over the 1960 population. As calculated by the Census Bureau, the urban segment comprised 2,909,451 persons, 65.9 percent of the total, compared with 63.8 percent in 1960. The rural segment comprised 1,508,280 persons (34.1 percent of the total), compared with 36.2 percent in 1960. Ethnically, the 1970 population was distributed as follows: white persons, 4,258,959; nonwhites, 158,772, including 128,224 Negroes, 18,924 Indians, 2700 Chinese, 2648 Japanese, and a sprinkling of Filipinos and others. The percentage of native-born residents was 97; of foreign-born, 3. The major countries of origin of the foreign-born, in order of rank, were Germany and Poland. The 1970 population density averaged 81.1 per sq.mi., compared with 72.6 in 1960.

The chief cities are Madison, the capital and second-largest city, a manufacturing and trade center, site of the University of Wisconsin; Milwaukee, the largest city, a port on Lake Michigan and a center of machinery and beer manufacturing; and Racine, the third-largest city, a port on Lake Michigan and a rail and manufacturing center.

The Chippewa are the most numerous Indians in Wisconsin, occupying reservations at Bad River, Lac Courte Oreilles, Lac du Flambeau, Mole Lake, and Red Cliff and communities at Saint Croix, Clam Lake, Danbury, Round Lake, and Sand Lake. Other tribes having reservations in the State are the Oneida, Forest Potawatomi, Stockbridge-Munsee, and Winnebago. The Menominee Indian reservation was made a county in 1961.

Education. The public-school system of Wisconsin was established in 1848. Education is compulsory for all children between the ages of seven and eighteen.

ELEMENTARY AND SECONDARY SCHOOLS. In 1972-73 public elementary schools numbered about 1730, public junior high schools, 195, and public secondary schools, 430. Enrollment was about 574,900 in elementary, 124,200 in junior high, and 296,100 in secondary schools. Teachers in the public-school system numbered about 27,200 elementary and 23,930 junior high and secondary teachers. In 1972-73 private institutions included about 725 elementary schools with some 150,575 students, 3 junior high schools with 380 students, and 80 secondary schools with 29,665 students.

UNIVERSITIES AND COLLEGES. In 1971 all public colleges and universities were merged into the University of Wisconsin System, which includes four-year campuses at Eau Claire, Green Bay, La Crosse, Madison, Menomonie, Milwaukee, Oshkosh, Parkside, Platteville, River Falls, Stevens Point, Superior, and Whitewater, and 17 center system campuses. The 41 private institutions include Beloit College, Marquette University (qq.v.), Alverno College, Carroll College, Carthage College, Lawrence University, and Ripon College. Wisconsin also has a vocational education system, including a number of technical colleges.

Libraries and Museums. Wisconsin has more than 335 public libraries, the largest of which



The only remaining covered bridge in Wisconsin, preserved in a park near Cedarburg, now accommodates only pedestrian traffic
 Wisconsin Conservation Dept.

are the University of Wisconsin libraries, with about 2,550,000 volumes, and the Milwaukee Public Library, with more than 1,500,000 volumes, the latter is also a depository for Federal documents. Other notable libraries include the State (Law) Library and the State Historical Society Library (also a Federal depository), both in Madison. Cultural institutions include the Neville Public Museum, in Green Bay; the Public Museums in Kenosha and Oshkosh, the Milwaukee Art Institute, the Milwaukee Public Museum, the John Nelson Bergstrom Art Center and Museum, in Neenah, noted for its collection of antique Austrian and Bohemian glass, and the Rhinelander Logging Museum, housed in a facsimile of an old-time logging camp. Of special interest is the Chalet of the Golden Fleece, in New Glarus, with Swiss objects housed in a mountain chalet, and where an outdoor performance of *Wilhelm Tell* by Friedrich Schiller is presented annually.

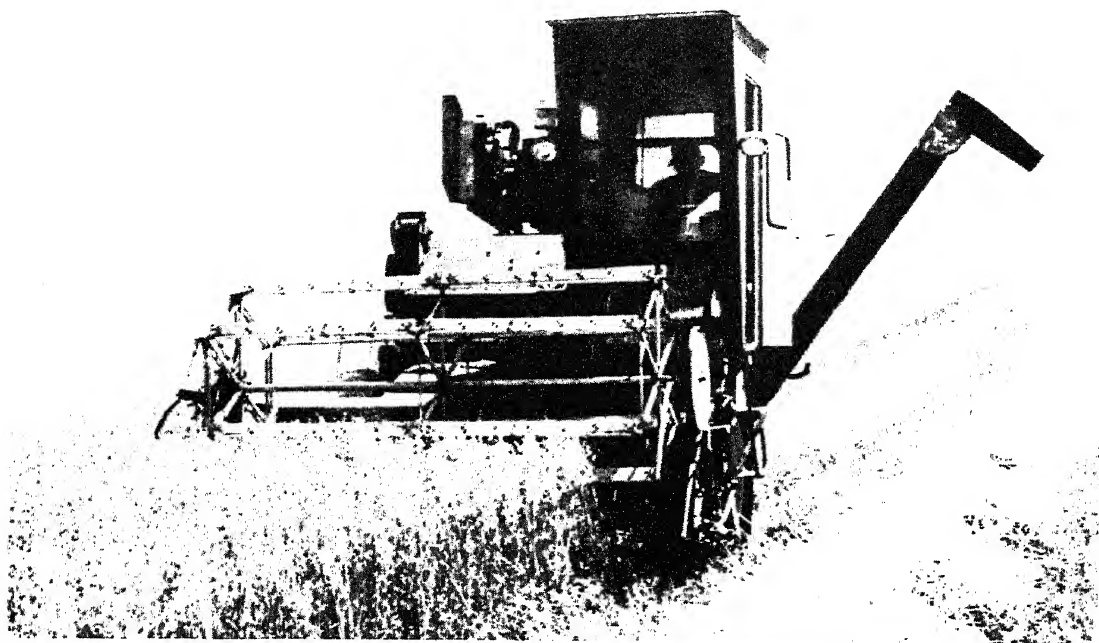
THE ECONOMY

Wisconsin has a diversified economy. Per capita personal income was \$6293 in 1976, compared with \$6441 for the U.S. as a whole. Agriculture employs more than 10 percent of the State's workers. Nonagricultural workers are employed, in descending order of numbers, in manufacturing, wholesale and retail trade, service industries, government, transportation and public utilities, finance, real estate, and insurance, and

construction. Tourism and travel contribute more than \$2.4 billion to the economy annually.

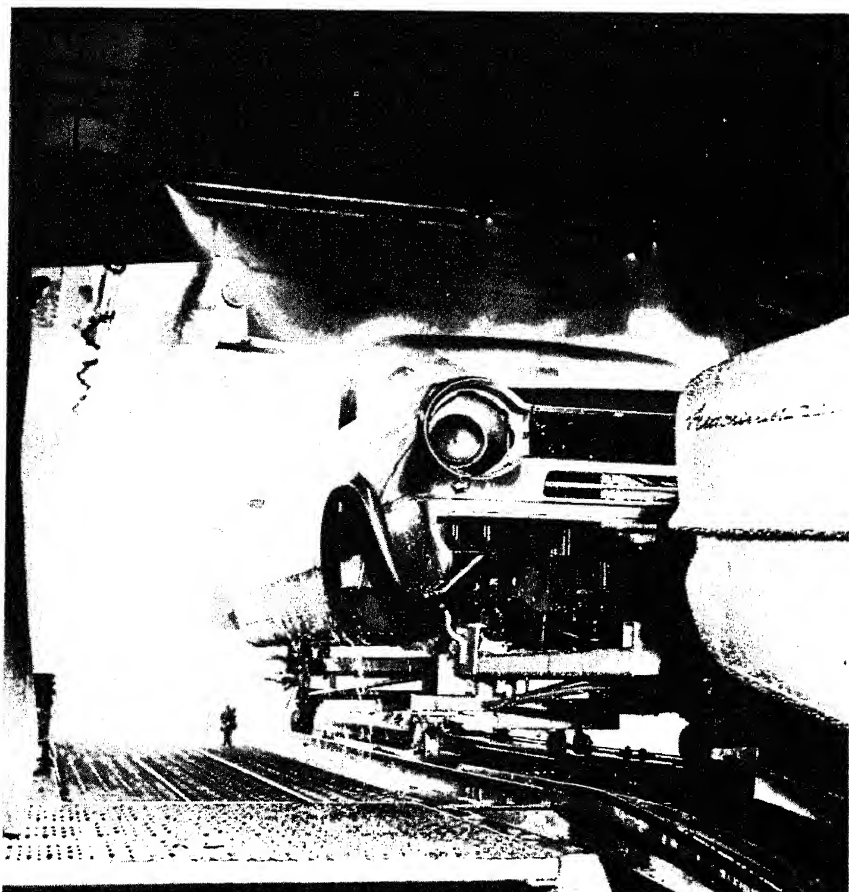
Manufacturing. According to a recent survey of manufactures, production workers in Wisconsin total 368,000. The largest groups are employed in the manufacture of nonelectrical machinery, food products, and transportation equipment. Other major industries are electronic equipment, primary metals, paper and allied products, and lumber products. About 37 percent of the production workers work in the Standard Metropolitan Statistical Area (qv) of Milwaukee and another 32 percent in the Minneapolis-St. Paul SMSA. Appleton-Oshkosh, Racine, Kenosha, and Green Bay are also important manufacturing centers. The value added by manufacture (see VALUE) in the largest industries in the mid-1970's was about \$2.88 billion annually for nonelectrical machinery, \$1.89 billion for food products, and \$1.23 billion for transportation equipment. The value added by all manufacturing in Wisconsin was about \$13.01 billion per year, ranking it eleventh in the U.S.

Agriculture. Wisconsin is the leading dairying State in the Union, and the ninth-ranking State overall in agricultural income. Its principal commodities, in order of value, are milk, cattle, hogs, and corn. Other major crops include hay, oats, and potatoes; the State is also a leading producer of green peas, lima beans, sweet corn for canning, cabbage, cranberries, and honey. About 198,000 workers work on some 100,000 farms covering 19,100,000 acres; the average size of a farm is 191 acres. In the mid-1970's total



A cutting and threshing combine harvests oats on a farm near Montfort in southwestern Wisconsin.

UPI



Automobiles move along an automated assembly line at a plant in Kenosha.

Wisconsin Conservation Dept.

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cash receipts from agriculture were about \$3.02 billion annually. Of this total about \$2.5 billion (or nearly 85 percent) was from livestock and related products and \$541,755,000 from crops.

Fishing. Wisconsin is one of the Great Lake States; its fisheries provide freshwater species. In the mid-1970's about 1200 fishermen were employed in the State. The annual catch was some 56,610,000 lb. valued at about \$3,968,000.

Mining. The most valuable minerals produced in Wisconsin, in order of value, are sand and gravel, stone, iron ore, and cement. In the mid-1970's the annual value of mineral production in the State was about \$132,000,000, giving it a rank of thirty-seventh in the U.S.

Energy. Generating plants in Wisconsin, with a capacity of 9,400,000 kw, produced about 37 billion kw hours of electric energy annually in the mid-1970's. About 11 percent of the production and almost 15 percent of the capacity were publicly owned. Among sources of energy were four utility-operated nuclear plants.

Forestry. The forests of Wisconsin consist predominantly of hardwoods. The commercial forest land, primarily under private ownership, is about 14,537,000 acres. It produces a net annual cut of sawtimber of some 796,000,000 bd.ft.

Transportation. The first railroad in Wisconsin was the Milwaukee & Mississippi Railroad, inaugurated on Nov. 20, 1850. The State is now served by several major railroads with about 5733 mi. of track. Rural and municipal roads total about 105,200 mi.; Federally assisted primary and secondary highways total some 24,928 mi., including 578 mi. in the Interstate Highway System. Wisconsin is served by 3 international and 6 local and interstate airlines, and has about 104 public and 199 private airports. Milwaukee, Green Bay, and Kewaunee are the most active lake ports.

Communications. The first newspaper in Wisconsin was the *Intelligencer*, founded in Green Bay in 1833. Today the State has about 36 daily newspapers and 6 Sunday papers. Among the leading newspapers are the *Milwaukee Journal* and *Sentinel* and the *Milwaukee State Journal*, published in Madison. Wisconsin has about 208 radio stations and 25 television stations. Among the oldest radio stations are KFIZ in Fond du Lac and WISN in Milwaukee, both established in 1922.

GOVERNMENT

Wisconsin is governed under the constitution of 1848, as amended. The executive branch consists of six State officers elected to four-year terms: the governor, lieutenant-governor, secretary of State, State treasurer, attorney general,

and superintendent of public instruction (the last two named each heads a department); fourteen departments, and fourteen independent agencies.

Legislative authority is exercised by the Senate, with thirty-three members elected for four-year terms; and the Assembly, with ninety-nine members elected for two-year terms. The legislative biennium consists of two annual sessions. The judicial system includes a seven-member supreme court, circuit courts, county courts, and municipal justice courts.

Wisconsin is represented in the United States Congress by two Senators and nine Representatives.

Local Government. Wisconsin is divided into seventy-two counties, which do not possess broad inherent powers of home rule, but which for many purposes form an intermediate level between the State and its cities, villages, and towns. The county governing body is the board of supervisors. The State has 571 incorporated cities and villages and 1269 townships. The two forms of city organization are mayor council and council manager.

Voting Qualifications. Suffrage is extended generally to U.S. citizens eighteen years of age who have resided six months in the State and ten days in the election district.

HISTORY

At the time the region now included in Wisconsin was first discovered by Europeans, it was the borderland between the hunting grounds of the Algonquian tribes, which were gradually pushing westward, and the Dakotas or Sioux, most of whom then lived beyond the Mississippi R. In 1634 the governor of New France dispatched Jean Nicolet (1598–1642), a French explorer, westward along the Great Lakes to make treaties with the remote tribes of Indians and to encourage them to trade with the French. Nicolet was the first white man to set foot in the region that is now Wisconsin, in 1634. The next white explorers to penetrate the region were Pierre Esprit Radisson (1636–?1710) and Medart Chouart, Sieur de Groseilliers (1625?–?97); in 1654 they visited the Green Bay region and four years later the Wisconsin shore of Lake Superior. In 1660 a Jesuit priest and seven traders passed through the region, and in 1665 the first mission was established in Wisconsin by Father Claude Jean Allouez (1622–89). Other French traders, explorers, and missionaries followed, and in 1673 Jacques Marquette and Louis Jolliet (qq.v.) journeyed up the Fox R., crossed to the Wisconsin R. by portage (the Fox-Wisconsin portage later figured prominently in the lucrative fur trade), and

then down the Wisconsin to the Mississippi R., which they reached on July 17. The French explorer Daniel Greysolon, Sieur Duluth (1636–1710), explored the Black, St. Croix, and upper Mississippi rivers in 1679, and continued exploration of the region for ten years.

End of French and British Rule. Because of the Indians the French were unable to establish a permanent settlement in Wisconsin until the middle of the 18th century. During the French and Indian War (q.v.), French supremacy in Wisconsin came to an end with the occupation of the region by the British in 1760. The Wisconsin Indians aided the British during the American Revolution. Following the Revolution, the region, although nominally a part of the United States, continued under the authority of the British. Jay's Treaty (q.v.) in 1794 contained provisions for the surrender of the British outposts, but the British continued to hold the territory until 1816, after the close of the War of 1812, when several detachments of the United States Army occupied Wisconsin and established forts in the region.

Statehood. The region, which had been part of the Northwest Territory (q.v.) since 1787, was attached to Indiana Territory in 1800, to Illinois Territory in 1809, and to Michigan Territory in

1818. In 1836, on the admission of Michigan to the Union, Wisconsin, including then the present States of Iowa and Minnesota and parts of the Dakotas, was established as a territory. In the following ten years the population increased rapidly, and Wisconsin was admitted to the Union as a State in 1848. During this period German and Scandinavian immigrants began to arrive in large numbers. Before the Civil War the antislavery sentiment in the State was very strong, and at Ripon in 1854 began one of the earliest movements that resulted subsequently in the organization of the Republican Party (q.v.). In the same year the State supreme court decided that the Fugitive Slave Laws (q.v.) were unconstitutional in Wisconsin. The share of the State in the Civil War was noteworthy. From a population of 775,881, Wisconsin furnished the Union army with 91,379 men; see CIVIL WAR, THE AMERICAN. Following the war, in the 1870's and 1880's, economic distress among the farmers gave rise to the formation of cooperative associations and to widespread support of the Granger movement (q.v.). Expansion of the Wis-

Youngsters gaze enthralled at historic posters at the Circus World Museum at Baraboo, seat of Sauk County, in a rich farming area of southern Wisconsin.

Wisconsin Dept. of Natural Resources



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consin lumber, wheat, and iron industries vastly strengthened the economy.

The 20th Century. An era of social progress and reform was inaugurated in 1900, when the liberal political leader Robert Marion La Follette (see under LA FOLLETTE) was elected governor of the State. In the next ten years social experiment and public-welfare legislation came to be identified widely with the "Wisconsin idea". The State was among the first in the Union to adopt a State income tax (1911) and a workmen's compensation law (1911); it was the first to adopt a State unemployment-insurance act (1932). Recent pioneering legislation includes a measure requiring seat belts in automobiles, and programs for abatement of water pollution and acquisition of recreation land.

Despite early voluntary actions by the State, civil-rights demonstrations in Wisconsin were directed toward school integration and open-housing legislation, primarily in urban areas. Wisconsin enacted legislation in 1949 prohibiting discrimination in public and urban-renewal housing, and this was expanded in 1965 to include private housing and in 1971 to include single-family, owner-occupied homes. In 1971 the Wisconsin legislature also lowered the age of majority to eighteen, passed a comprehensive consumer act, and merged all State universities to form the University of Wisconsin System.

Although the importance of Wisconsin's agriculture has declined since World War II, it remains vital to the State's economy in the 1970's. At the same time, manufacturing and the recreation industry have become major sources of revenue. The problems of urban congestion and the need for stricter environmental controls are increasingly apparent. Today Wisconsin faces the challenge of providing improved living standards, job opportunities, and public programs, while maintaining its traditional climate of progressivism based on political stability.

WISCONSIN, river in Wisconsin. It rises in Lac Vieux Desert, near the border with Michigan, and flows 430 miles s. and w. to the Mississippi R. It is broken by many rapids and falls, but is navigable to Portage City (200 mi.), where it is connected to the Fox R. by a short canal. The Wisconsin is thus part of the continuous waterway between Lake Michigan and the Mississippi R.

WISCONSIN DELLS, city of Wisconsin, in Columbia Co., on the Wisconsin R., 43 miles n.w. of Madison. The city is known chiefly for its picturesque canyons along the river and is the gateway to the so-called Dells of Wisconsin. It is

a summer tourist resort, and water shows are held here. Processed goods produced in the city include butter, pickles, and hardware. Settled about 1850, the city was incorporated in 1925 as Kilbourn and adopted the name Wisconsin Dells in 1931. Pop. (1960) 2105; (1970) 2401.

WISCONSIN RAPIDS, city in Wisconsin, and county seat of Wood Co., on the Wisconsin R., about 37 miles s.w. of Wausau. Manufactures include clothing and paper products. Some of the chief industries are dairying and cranberry growing. Wisconsin Rapids was incorporated as a city in 1869. Pop. (1960) 15,042; (1970) 18,587.

WISCONSIN, UNIVERSITY OF, coeducational State-controlled land-grant institution (see LAND-GRANT COLLEGES) of higher learning, at Madison, Wis. It is the oldest and largest unit of the University of Wisconsin System, formed in 1971 and including universities at Eau Claire, Green Bay, La Crosse, Menomonie, Milwaukee, Oshkosh, Parkside, Platteville, River Falls, Stevens Point, Superior, and Whitewater. The university at Madison was opened in 1849. The major divisions are the colleges of letters and science, which include professional schools in journalism, library science, music, and social work; colleges of engineering and agriculture; and schools of education, business, pharmacy, law, medicine, nursing, home economics, and graduate studies. Since 1946 students at the college of letters and science have had the choice of two groups of curricula, one designed for those preparing for particular professions, and one for those who desire a more general education. The university awards the degrees of associate, bachelor, master, and doctor.

The university's extension and public-service programs pioneered many services that American universities presently offer. The university acts as the State research center, organizes conferences, circulates educational films, and performs other services for the public. Among the specialized research and public-service agencies established on the campuses are the Wisconsin Alumni Research Foundation, the Washburn Observatory, the Wisconsin Historical Society, the Wisconsin Psychiatric Institute, the State Crime Laboratory, an arboretum, agricultural-experiment stations, hospitals, and radio and television stations.

The university has some 400 buildings and 880 acres of land in Madison and more than 4300 acres elsewhere in the State. In 1972 its libraries contained more than 2,500,000 volumes. In 1972 student enrollment at the Madison campus totaled 34,866 and faculty numbered about 6000. The endowment was about \$27,000,000 in 1973.

WISDOM OF SOLOMON, book of the Old Testament Apocrypha (see BIBLE: *The Apocrypha*), in the King James Version, THE WISDOM OF SOLOMON. Jews do not include it in the Hebrew Bible; Roman Catholics, however, regard it as canonical; see BIBLE, CANON OF THE; DEUTEROCANONICAL BOOKS.

Authorship. The book purports to be a work of the Hebrew king Solomon (q.v.), but scholars have long doubted Solomon's authorship. On the basis of internal evidence, many today regard the book as the work of an unknown Jew, probably in the Greco-Egyptian city of Alexandria (q.v.), during the latter half of the 1st century B.C. The language of the original is almost universally believed to have been Greek, although it has been suggested that the author may have used Palestinian and Greco-Egyptian sources, including, perhaps, material originally in Hebrew. He seems to have written for Greek-educated Jews.

Content. The first five chapters of the book perhaps derived from Palestinian Hebrew sources, urge the readers to love righteousness and to seek God, that thereby they may acquire wisdom and immortality. The miserable fate of the ungodly that is, the unwise, is contrasted with the expected blessedness of the righteous. Chapters 6–9 are a further commendation of wisdom as the guide of man. The nature of wisdom, its importance, and how one may find it are described, and in the first person, ostensibly that of Solomon, the writer describes his own search for wisdom. Throughout the first ten chapters, wisdom usually is personified as a woman. In the rest of the book, however, the word "wisdom" scarcely appears, and the concept of it is quite abstract. Chapters 10–19, the remainder of the book, chiefly describe the way in which Israel (q.v.) and Israel's ancestors were saved through wisdom. Thus, chapters 10–12 illustrate the saving power of wisdom from the time of the legendary father of humanity, Adam (see ADAM AND EVE), to the time of the Hebrew lawgiver and prophet Moses (q.v.); and chapters 16–19 illustrate the importance of behaving wisely, or piously, through God's contrasting treatment of the Egyptians and the Israelites (see EXODUS). Chapters 13–15, a digression, reflect on the origin and folly of various forms of idolatry (q.v.). The book seems to end abruptly; it is possible that the author's inspiration failed, or that the original conclusion of the book was lost.

See also ECCLESIASTES; PROVERBS.

WISE, Isaac Mayer (1819–1900), American rabbi (q.v.), religious scholar, organizer, and ed-

ucator, born in Steingrub (now Lomnice, Czechoslovakia). Educated in Prague, he entered the rabbinate in Bohemia in 1843. A non-conformist in his religious and political views, he emigrated to the United States in 1846 and became the rabbi of a congregation in Albany, N.Y. He was rabbi of Congregation B'nai Jeshurun in Cincinnati, Ohio, after 1854. Believing that traditional Judaism lacked the flexibility to meet the ever-changing conditions of the modern world, he became one of the outstanding pioneers of the Reform movement in American Jewish life; see JUDAISM: *Modern Judaism*. He expounded his views in the newspapers *The American Israelite* and *Die Deborah* (published in German), which he established (1854 and 1855, respectively) and thereafter edited. A great organizer, Wise founded the three leading Reform organizations in the United States, namely, the Union of American Hebrew Congregations, in 1873; Hebrew Union College (now Hebrew Union College-Jewish Institute of Religion, q.v.), in 1875, the first school in the U.S. for the preparation of rabbis; and the Central Conference of American Rabbis, in 1889. Wise was president of the latter two institutions up to the time of his death. Some of his numerous writings, which include essays, novels, plays, and a revised prayer book, are *History of the Israelitish Nation* (1854), *Origin of Christianity* (1870), *Judaism: Its Doctrines and Duties* (1872), *The Cosmic God* (1876), *Judaism and Christianity* (1883), and *Reminiscences* (posthumously published, 1901).

WISE, Stephen Samuel (1874–1949), American rabbi (q.v.) and Jewish leader, born in Budapest, Hungary. When he was a year old his family settled in New York City. He was educated at Columbia University and, after completing his basic education, he served as a rabbi in New York City (1893–1900) and in Portland, Oreg. (1900–06). In 1901 he received the doctorate in philosophy from Columbia. In 1907, in New York City, he founded the Free Synagogue (now the Stephen Wise Free Synagogue). There, as the name implied, the rabbi was given total freedom of speech and, unlike the situation in other synagogues (see SYNAGOGUE), the pews were free and unassigned instead of being sold to purchasers for their exclusive use. He served as rabbi of the Free Synagogue from its inception to his death.

Rabbi Wise was famous for his work in the Zionist movement (see ZIONISM), notably in organizing the Zionist Organization of America (q.v.). He founded or helped to found the American Jewish Congress, in 1914–15; the Jew-



Rabbi Stephen S. Wise (center) talks with two Nobel Prize winners, the physicist Albert Einstein (left) and the novelist Thomas Mann in New York City in 1938.

ish Institute of Religion (now part of Hebrew Union College-Jewish Institute of Religion, q.v.), in 1922; and the World Jewish Congress, in 1936. He was one of the leaders of the Reform movement in American Jewish life; see JUDAISM: *Modern Judaism*. His writings include *The Ethics of Solomon Ibn Gabirol* (1901), *Child versus Parent* (1922), and the autobiography *Challenging Years* (1949).

WISE MEN, THE. See MAGI.

WISHART, George (about 1510–46), Scottish Protestant reformer and martyr, born near Montrose in the county of Forfar (now Kincardine). In 1538, while a schoolmaster in Montrose, he was charged with heresy (q.v.) for teaching the New Testament in Greek. He fled, first to England and later to the Continent. From 1540 to 1543 he lived mostly in Germany and in Switzerland. He later translated into English the First Helvetic Confession, which had been written in 1536; see BASEL, CONFESSION OF. Wishart was a tutor at the University of Cambridge for a period, probably in 1543, and the same year went back to Scotland. There he began to preach vigorously the doctrines of the Reformation (q.v.). His inflammatory sermons antagonized the Scottish Roman Catholic prelate Cardinal David Beaton (1494–1546). In January, 1546, Beaton had Wishart arrested. Convicted of heresy, he was burned at the stake at Saint Andrews in March, 1546. Wishart's friends were said to have avenged his death when Cardinal Beaton was assassinated three months later. Wishart laid the groundwork of the Reformation in Scotland; his activities profoundly influenced the career of the Scottish reformer John Knox (q.v.), his intimate friend and disciple.

WISSELER, Clark (1870–1947), American anthropologist, born in Wayne County, Ind., and educated at Indiana State and Columbia universi-

ties. He became an instructor of New York University in 1901 and was lecturer at Columbia University from 1903 to 1909. Wissler served as curator of the American Museum of Natural History in New York City from 1906 to 1941, and was professor of anthropology at Yale University from 1924 to 1940. An authority on the American Indian, Wissler is noted especially for his field studies of the Blackfoot (q.v.) and Siouan tribes; see SIOUX. He also developed the new anthropological system of classification of ethnological data according to culture areas; see ANTHROPOLOGY; ETHNOLOGY. His writings include *North American Indians of the Plains* (1912), *Man and Culture* (1922), *Social Anthropology* (1929), *The American Indian* (1917), and *The Indian in the United States* (1940).

WISTER, Owen (1860–1938), American writer, born in Philadelphia, Pa., and educated at Harvard University. He was the grandson of the famous British actress Fanny Kemble (see under KEMBLE). After first preparing for a musical career, he was admitted to the bar in 1889 and practiced law in Philadelphia for two years. Visits to Wyoming and a stay of several years in New Mexico and Arizona provided him with material for a number of short stories and novels about the West. His greatest literary success, *The Virginian* (1902), was a best seller for years, had a ten-year run in a stage version, was several times made into a motion picture, was the basis of a television series (1962–71), and remains a prototype of stories about the West. Wister's other writings include the novel *Lady Baltimore* (1906) and the biography *Roosevelt, The Story of a Friendship* (1930).

WISTERIA, or WISTARIA, scientific and common name of a genus of woody, climbing plants of the Pea family, Leguminosae. About a half-dozen species are cultivated. The best-known

wisterias are the Chinese, *W. sinensis*; the Japanese, *W. floribunda*; and the American, *W. frutescens*. Wisterias are commonly planted for training over trellises, doorways, or porches and bear showy hanging clusters of pealike, blue or violet flowers. These plants may in time produce branches several hundred feet long and



Chinese wisteria, *Wisteria sinensis*

several inches in diameter. The leaves are compound, with seven to nineteen leaflets. The fruit is an elongate legume pod.

Children have been poisoned by eating the seeds or pods of wisterias. Symptoms include repeated vomiting with abdominal pain and diarrhea. The poison is unknown. J.M.K.

WITCHCRAFT, exercise of supposed supernatural powers by people who call themselves witches. Witches are assumed to be servants of the Devil (q.v.) and in this respect differ from sorcerers, wizards, warlocks, conjurors, and other practitioners of black magic, who have supposedly learned to master the Devil. Most witches have been women, and in current popular usage the term "witch" is applied only to women; but many men have been alleged to be witches, and the term properly applies to both sexes. Witchcraft is worldwide in scope, but has had greatly varying roles at different times and places. This article will deal first with the main Western tradition of witchcraft and then with other traditions.

The Powers of a Witch. Witchcraft depends upon certain presuppositions. These include the beliefs that the Devil and his subordinates, such as demons, imps, incubi, and succubi (see DEMON), are real and have power in the world; that people can have physical relations with them; and that contracts between people and demons can be enforced. In return for serving the Devil according to contract, witches allegedly receive certain powers, notably to cause or cure illness or transfer it from one person to another; to raise storms, make rain, or sometimes drought; to produce impotence in men and sterility in women; to cause crops to fail, animals to be barren, and milk to go sour. They are believed able to arouse love through the use of philters and potions and to destroy love by charms and spells; to do harm or even bring about death by a glance (the so-called evil eye) or by sticking pins into a wax image of the victim. They supposedly can become invisible and fly, sometimes with the aid of a broom or special ointments. Witches allegedly foretell the future; animate inanimate objects, revive the dead, and conjure up other spirits; and transform themselves and others into animals, particularly cats and wolves (see WEREWOLF).

Many reputed witches were skilled in the preparation of herbs for various uses, and others certainly indulged in malicious mischief; a few of the powers listed above can be shown to have depended on acts of vandalism or practice of folk medicine. The more uncanny powers were largely imaginary, but some may be partly explained as the effects of suggestion by the witch on herself and others. Among the aborigines of Australia, witch doctors have been suspected of causing death by pointing a bone or stick at an intended victim; if the victim is sufficiently open to suggestion, the idea that he is doomed will make him refuse food and drink until he dies. In all ages, the mere suggestion that a witch had cast a spell upon a person or had put pins into his image has on occasion led to illness and sometimes even death. The witch, being undoubtedly autosuggestive, could convince herself readily that she was invisible or flying, especially if she were under the influence of drugs in ointments she rubbed on her body or in potions that she swallowed.

European Witchcraft. According to most authorities, witches in Europe in medieval times and later were organized into covens of twelve members, mainly but not exclusively females, and a leader, usually a male. The leader was the vicar of the Devil and was regarded by many of his simpler worshipers as the Devil himself. Tra-

WITCHCRAFT

ditionally, he is represented as dressed all in black or in the guise of a goat, stag, or other horned animal. The coven assembled once or twice a week in a meeting called an *esbat*, which was generally a local gathering. At these meetings, the witches performed acts of Devil worship, reported on their activities, and made plans for the coming week. Larger regional meetings were called Sabbats, to which would come hundreds, sometimes thousands, of joyous revelers, including witches and their uninitiated followers. The most celebrated meeting place in ancient and medieval Europe was Brocken (q.v.), the highest peak in the Harz Mts. of Germany, the scene of the Sabbat so vividly described in the drama *Faust* by the German poet Johann Wolfgang von Goethe (q.v.). The two most important Sabbats were held on the night of April 30 (Roodmas or *Walpurgisnacht*) and the night of October 31 (Halloween). Sabbats were celebrated also on the nights of July 31 (Lammas) and February 1 (Candlemas) and probably on other nights.

The opening procedure at a Sabbat was the initiation of new members. The initiation ceremony supposedly involved taking the oath of obedience to the Devil, signing contracts with him in blood, desecration of crucifixes and other sacred objects; assignment of a familiar, in the form of a cat, mouse, weasel, toad, or other small animal, to do the bidding of the witch; and various obscene acts of obeisance to the Devil and his vicar. Initiation was followed by general worship, including frequently the Black Mass, which was a travesty of the Catholic Mass; see SATANISM. Worship blended into dancing, which became increasingly wild and indecent. The Sabbat ended in a sexual orgy.

HISTORY

From what is known of the Sabbat and from other evidence, most contemporary scholars have come to the conclusion that witchcraft was the survival of an ancient folk religion, essentially a fertility cult, that prevailed over all of Europe before the advent of Christianity. According to this theory, the old religion continued to exist alongside Christianity through medieval times, though constantly losing adherents and importance. As Christianity gained the ascendancy, it persuaded most people to regard the gods of the old religion as devils. Those who continued to practice the old religion became witches in the eyes of ecclesiastical authorities and orthodox Christians.

In the Bible. References to witchcraft go back to the beginnings of history. The belief in magical practices, through the agency of spirits and

demons, was almost universal in ancient times. Egyptian records tell of conjurers and soothsayers who derived their powers from alien gods, or, devils. In the Egyptian account of the encounter between the Hebrew prophet Moses (q.v.) and Pharaoh, Moses appears as a practitioner of black magic and his followers as servants of an alien and abhorrent God; accordingly they are witches. In the Biblical account of the same episode, the Egyptian experts who competed with Moses appear as evil sorcerers. The Biblical injunction "Thou shalt not suffer a witch to live" (Exod. 22:18) was one of the main justifications of the witch persecutions of later days. An even earlier prohibition of witchcraft is contained in the Code of the Babylonian king Hammurabi (q.v.). Yet witchcraft continued to flourish, and Chaldeans, Egyptians, and other eastern peoples were known for their mastery of the black art.

In the Ancient World. Witches and magicians figured significantly too in the civilizations of ancient Greece and Rome; Thessaly (q.v.), in Greece, was a particularly important center of the black magic. The first major witch-hunt in the modern sense occurred in 367 A.D. by order of the Roman emperor Valerian (q.v.).

In its early period, the Christian Church was lenient toward witchcraft. Persons proved to have practiced it were required only to do penance. Clergymen, still struggling to consolidate the power of the Church, recognized that all-out conflict with the extremely numerous devotees of the old religion would be disastrous. They therefore tolerated the old worship and, according to reliable records, frequently participated.

Christian Opposition. The attitude of the Church began to stiffen as it grew strong enough to fight openly against the already disintegrating old faith. Also, growing social unrest during the later Middle Ages (q.v.) and early modern times found expression in witchcraft as well as in heresy (q.v.) and secularism. Because those tendencies threatened to undermine ecclesiastical authority, the Roman Catholic Church treated secularism as heresy, identified heresy with witchcraft, and attempted to destroy all three. The most influential papal bull against witchcraft was the *Summis Desiderantes* promulgated by Pope Innocent VIII (1432–92) in 1484. To implement this bull, he appointed regional inquisitors, among them Jacobus Sprenger (1436–95) and Henricus Kramer (1430?–1505?), the authors of *Malleus Maleficarum* ("Hammer of Witches"). This book, the most famous work against witchcraft, became the text-



Witches are burned at the stake (woodcut from a German pamphlet published in 1555).

book of Catholic witch-hunters. *Daemonologie*, written about a century later by James I (q.v.), King of England, served as a similar guide for Protestant witch-hunters.

The witch-hunting mania obsessed Europe from about 1050 to the end of the 17th century; it subsided occasionally, but then attained greater fury. Children were encouraged to inform against parents, husbands against wives, relatives and neighbors against each other. Witnesses were paid to testify. The most inhuman tortures were inflicted to force confessions. The inquisitors did not scruple to betray promises of pardon to those acknowledging guilt. There arose a class of professional witch finders who collected charges and then tested the accused for evidences of witchcraft. They were paid a fee for each conviction. The most common test was pricking. All witches were supposed to have somewhere on their bodies a mark, made by the Devil, that was insensitive to pain. If such a spot was found, it was regarded as proof of witchcraft. Among other proofs were additional breasts, supposedly used to suckle familiars, inability to weep, and failure in the water test. In this last-named test, if a woman sank when thrown into a body of water, she was considered innocent; if she stayed afloat, she was guilty.

By use of such methods, charges of witchcraft were easily sustained. The number of those condemned to death for witchcraft is difficult to estimate, largely because reports of executions did not distinguish between heretics and witches. Approximately 1000 persons were executed in

one year in the district of Como, Switzerland, and available records indicate that most of the victims were reputed witches. During the Inquisition (q.v.) in Toulouse, France, 400 witches and heretics were put to death in a single execution. The persecution of witches was particularly severe in Germany. In Nuremberg alone, between 100 and 200 persons were burned annually, chiefly on charges of witchcraft. Estimates of the total number of persons executed in Europe for witchcraft from the 11th to the 18th centuries range from 300,000 to 9,000,000.

The witch-hunting craze spread inevitably to the New World. Throughout the 17th century sporadic prosecutions for witchcraft took place in Massachusetts, Connecticut, and Virginia. The mania reached its peak in the notorious witch trials of 1692 in Salem, Mass. (q.v.); see DANVERS. On the basis of statements extracted from children who had been stimulated to hysteria by stories told by an old West Indian servant, more than 200 persons were imprisoned, 55 were tortured, 19 were hanged, and 1 was pressed to death.

By the beginning of the 18th century the witch-hunting frenzy had spent its force. The genuine practitioners of the old religion had either been killed or terrified into conformity. Heresy had been institutionalized into an endless variety of sects that had to be tolerated. The last execution for witchcraft in England took place in 1716; the last in Scotland in 1722. The last judicial killing for witchcraft on the Conti-

WITCH HAZEL

ment occurred in 1782, when a servant girl was sentenced to death in Glarus, Switzerland.

Modern Witchcraft. Witchcraft in other parts of the world is essentially similar to that of the main Western tradition. The most important difference is that among many primitive peoples, witches (called also witch doctors, medicine men, or shamans) have established and unchallenged roles in the community. They are assumed to derive their power from evil spirits, but these spirits are revered, or at least feared, by the community; persons who are thought to have access to the spirit world are regarded with reverence or fear. Witch doctors are depended upon to cure the sick, make rain, and assure success in the hunt and in war; to exorcise demons that may possess members of the community and to propitiate demons that may otherwise turn hostile; to smell out evil, denounce evildoers, and accomplish their ruin. In India primitive tribes and members of the lower castes commonly resort to witches and sorcerers. Even upper-caste Hindus may turn to them in time of drought and famine. Witches play an important part in daily life in Burma, Malaysia, Indonesia, and other parts of Asia. Witchcraft is widespread also in Africa. The voodoo (q.v.) of Haiti and other Latin American countries is a form of witchcraft, as are the devil cults of the Solomon Islands and the New Hebrides.

Witchcraft persists in fact in almost every country. In the United States, belief in witchcraft endures among Southern mountain people and other relatively isolated groups. Until quite recently the hex or witch was greatly feared in some parts of Pennsylvania, and farmers painted special designs on their barns to ward off witch-induced disasters. Even in large cities believers in the evil eye and other powers of witchcraft may still be found.

In recent years, public interest in various types of occultism (q.v.) has increased. Books on witchcraft and astrology (q.v.) have been published with some frequency, and persons purporting to be witches have appeared in Europe and the U.S.

See also **RELIGION: The Primitive Religions.**

WITCH HAZEL, common name applied to a family, Hamamelidaceae, of deciduous shrubs and trees and to its principal genus, *Hamamelis*. The genus, which contains four species, is native to North America and Asia, and is cultivated as an ornamental plant. The yellow, axillary flowers have a four-parted calyx, four petals, four stamens, and two pistils. The fruit is a woody, dehiscent, two-seeded capsule. The species *H. virginiana*, native to eastern United

States and Canada, occurs as a shrub and averages 6 ft. in height. The shrub or tree *H. mollis* is found in central China and grows to a height of 30 ft. The Japanese witch hazel, *H. japonica*, occurs as a tree or shrub and reaches a height of 30 ft. The bark and leaves of the witch hazel yield extracts, which are used medicinally in the treatment of bruises and sprains.

WITENAGEMOT or WITAN (OE., "meeting of the wise men"), in Anglo-Saxon history, assembly of councilors that met to advise the king of judicial and administrative matters. Originally a gathering of all the freemen of a tribe, it eventually became an assembly composed of the ealdormen (OE., "aldermen"), or local chieftains, the bishops, other high civil and ecclesiastical officials, and sometimes friends and relatives of the king. The witenagemot elected or approved the king and also had the power to depose him; it deliberated on all new laws, made treaties, served as a supreme court of justice, authorized the levying of extraordinary taxation and the granting of land, and raised military forces. Each of the several Anglo-Saxon kingdoms had its own witenagemot until the subjugation of them all by Egbert (q.v.), King of Wessex, between 825 and 829. Thereafter the Witenagemot of Wessex gradually developed into a single assembly for the whole country; see **ALFRED**. After the Norman Conquest of England in 1066 (see **WILLIAM I**) the witenagemot was superseded by the Great Council, an advisory body to the Anglo-Norman kings. See **ENGLAND: History**; **PARLIAMENT**.

WITHERSPOON, John (1723-94), American clergyman, educator, and statesman, born near Edinburgh, Scotland, and educated at the University of Edinburgh. He held Presbyterian pastorates in Scotland from 1745 until 1768, when he accepted an invitation to become president of the College of New Jersey (now Princeton University). Besides developing and enlarging the college, Witherspoon furthered the growth of the Presbyterian Church in America; see **PRESBYTERIANISM**. A member of the Continental Congress (q.v.) from 1776 to 1779 and from 1780 to 1782, he signed the Declaration of Independence (q.v.). Witherspoon was also a delegate to the New Jersey convention of 1787 that ratified the Constitution of the United States (q.v.).

WITNESS, in law in England and the United States, a term used in two senses. It may be used to designate a person who testifies or gives evidence (q.v.) in a judicial or quasi-judicial proceeding; or it may refer to a person who attests to or is present at the execution of a legal instrument such as a deed, an affidavit or a will (q.v.).

Witness' Rights. An oath is required of every

person called to testify at a judicial or quasi-judicial proceeding; in some jurisdictions a witness such as an atheist, who has conscientious scruples against taking an oath, may instead make what is called an affirmation. Not every person may be competent to testify as a witness; for example, a person of unsound mind may not be a witness. An infant may be permitted by the court to testify if the court is convinced that the infant understands the nature of an oath. A judge cannot be a witness in a case being tried before him. A person convicted of a crime is considered a competent witness. A person with some interest in the outcome of a civil action involving a deceased person cannot testify as to personal transactions or communications with the deceased.

The attendance of a witness at a judicial or quasi-judicial proceeding is compelled by the issuance of a subpoena (q.v.); only witnesses within the jurisdiction of the court may be subpoenaed. Forty-four States, however, have agreed on a mutual basis to extend their process to a multi-State jurisdiction. A witness may not be compelled to give evidence against himself; he may refuse to answer any questions the answers to which might incriminate him. On the other hand, even when he is granted immunity (q.v.), he may be compelled to answer; in such a case his answer may not, however, be put to use to convict him of a crime. A person called as a witness cannot be compelled to testify concerning a privileged communication, such as information given to a lawyer by a client, or a confidential communication, such as that between a husband and a wife. The examination of a witness is said to be a direct examination when the witness is testifying on behalf of the party that has subpoenaed him or that has requested him to testify; the examination is said to be a cross-examination when the witness is questioned by the attorney for the opposing party. In some jurisdictions, in a criminal prosecution, the uncorroborated testimony of an accomplice will not justify a conviction.

In the second sense of the term, witnesses are necessary for the legal validity of certain documents and ceremonies. The number of witnesses required in nonjudicial matters varies among the various jurisdictions; thus, most States of the U.S. require two witnesses to attest the execution of a will, while others require three signatures. In all States two witnesses are required for a marriage. G.R.B.

WITTELSBACH, German ruling family, closely connected with the history of Bavaria (q.v.). The family name was taken from the castle of Wit-

telsbach, which once stood on the Paar R. in Bavaria. Otto V, Count of Scheyern (d. 1155), moved to Wittelsbach in 1124 and adopted the name. Count Otto VI (d. 1183) succeeded his father in 1155. Otto VI, who served Frederick I (q.v.), Holy Roman Emperor, in Italy in 1154 and thereafter in Germany, was made duke of Bavaria in 1180, when Henry the Lion (q.v.), Duke of Saxony and Bavaria, was placed under imperial ban. Thereafter, various branches of the Wittelsbachs ruled over Bavaria until the German revolution of 1918 and the abdication of Louis III, King of Bavaria (*see under* LOUIS). The ancestral castle was destroyed in 1208.

The family redistributed its lands over the centuries. By the Treaty of Pavia in 1329, Louis IV (q.v.), Holy Roman Emperor and former duke of Bavaria, installed his nephews, Rudolf II (d. 1353) and Rupert I, as rulers of the Palatinate of the Rhine and the Upper Palatinate of Bavaria; *see* PALATINATE. After Rudolf's death, Rupert was sole ruler of both until 1390. The remaining portions of Bavaria were retained by other descendants of Louis IV. The branches of Landshut, Munich (q.v.), and Ingoldstadt resulted from another division of holdings in 1392. The holdings were reunited under Albert IV, Duke of Bavaria-Munich (1447-1508), and the Upper Palatinate was added in 1628. Albert's descendants ruled over a united Bavaria until Duke Maximilian III (1727-77) died. He was succeeded by the elector palatine Charles Theodore (d. 1799). The elector Maximilian (1756-1825), who succeeded in 1799, proclaimed himself as Maximilian I Joseph, the first king of Bavaria in 1806. *See also* ELECTORS, GERMAN IMPERIAL; SUCCESSION WARS: *War of the Bavarian Succession*.

Three Wittelsbachs ruled as kings of Germany and Holy Roman emperors: Louis IV; Rupert (1352-1410), an uncrowned emperor; and Charles VII (q.v.). Members of the family were also margraves of Brandenburg (q.v.) from 1323 to 1373, and kings of Sweden from 1654 to 1718. **WITTEN**, city of West Germany, in North Rhine-Westphalia State, on the Ruhr R., 8 miles s.w. of Dortmund. An industrial center, it has factories engaged in the manufacture of iron and steel, machinery, coal-tar products, and glass. Witten was chartered as a city in 1825. It sustained heavy damage in World War II. Pop. (1970) 97,700.

WITTENBERG, city of East Germany, in Halle District, on the Elbe R., about 55 miles s.w. of Berlin. It is a railroad junction, and there are factories engaged in the manufacture of textiles, hosiery, leather, machinery, pottery, electrical apparatus, bricks, cement, and chemicals.



The University of Wittenberg as it appeared about the middle of the 17th century.

German Information Center

"Cradle of the Protestant Reformation".

Wittenberg contains many architectural landmarks associated with the great religious upheaval. Particularly noteworthy is the Schlosskirche ("castle church"), on the door of which the German religious reformer Martin Luther (q.v.) nailed his ninety-five theses against the granting of indulgences; see *INDULGENCE*. Within the church are the tombs of Luther and of the German religious reformer Melanchthon (q.v.). Of interest, too, are the home of Luther, now a museum; the houses of Melanchthon and of the German painter and etcher Lucas Cranach (q.v.) the elder; and the parish church, dating from the 14th century, where Luther preached. Luther, Melanchthon, and the German religious reformer Johann Bugenhagen (q.v.) all were faculty members of the University of Wittenberg (1502), which merged with the University of Halle in 1817. The spot where Luther burned the papal bull condemning his doctrines is marked by an oak tree.

History. The city was cited as early as 1180 and served (1273–1422) as the capital of the duchy of Saxony-Wittenberg. The house of Wettin obtained control of the city in 1423. It passed to the Al-

bertine line of the Wettin house in 1547 under the terms of the treaty known as the Capitulation of Wittenberg. Meanwhile, the city had become the focal point of the Reformation. In 1534 the first Lutheran Bible was printed there. The city sustained heavy damage in the Thirty Years' War and in the Seven Years' War (qq.v.).

Wittenberg, following the deliberations at the Congress of Vienna (see *VIENNA, CONGRESS OF*), was annexed by Prussia in 1815. It was occupied by Soviet troops in April, 1945, during World War II (q.v.), and was included in the Soviet zone of occupation. Pop. (1972 est.) 47,640.

WITTENBERG UNIVERSITY, coeducational institution of higher learning, located in Springfield, Ohio, and maintained by the Lutheran Church in America. The university was founded in 1845 as Wittenberg College (for men); women were admitted in 1874, and the present name was adopted in 1959. The university emphasizes liberal arts programs and training in theology and includes Hama School of Theology (1845), schools of music (1887) and community education (1955), and provides for study abroad. The degrees of bachelor and master are conferred. Among noted graduates are the American publishers Isaac Kauffman Funk and Adam Willis Wagnalls and the American novel-

st Lloyd Cassel Douglas (q.v.). In the late 1960's the library housed 147,000 bound volumes. In 1972-73 enrollment totaled about 3300, the faculty numbered 290 members, and the endowment was more than \$11,599,000.

WITTGENSTEIN, Ludwig (Josef Johann) (1889-1951), British philosopher, born in Vienna, Austria. He studied engineering in Berlin and conducted aeronautical research in Manchester, England. From 1912 to 1914 he studied with British philosopher Bertrand Russell, 3rd Earl Russell (q.v.). After service in the Austrian army in World War I, Wittgenstein was a schoolteacher and architect in Austria. In 1929 he returned to England, received a Ph.D. degree from the University of Cambridge, and began an influential career as a professor of philosophy there. Wittgenstein became a naturalized British subject in 1938. Only one of his works, *Tractatus Logico-Philosophicus* (1921; German-English parallel text, 1922), was published during his lifetime. In it he attempted to probe the nature of reality, which he stated was inseparable from language and could be expressed only by language or by names, the logical pictures created by language. His later works on logic, knowledge, and aesthetics were less radical in theory. These posthumous works, all published in translation, include *Philosophical Investigations* (1953); *Remarks on the Foundations of Mathematics* (1956); *Blue and Brown Books: Classic Works in Modern Philosophy* (1958); *Notebooks: 1914-1916* (1961); and *Letters from Ludwig Wittgenstein* (1968). See also PHILOSOPHY: *Modern Philosophy: Analytical Philosophy*.

WITWATERSRAND, or THE RAND, rocky uplift and generally coextensive geographical region of Transvaal Province, Republic of South Africa. It is the most productive gold-mining district in the world. The uplift is about 62 mi. long in an e.-w. direction, has a maximum width of about 25 mi., and reaches an elevation of more than 2000 ft. above the surrounding plateau area. Surface gold was discovered in the region in 1884 and active mining operations began in 1886, the same year in which Johannesburg (q.v.) was founded as a gold-mining settlement. The main gold reef was discovered in 1889 at a depth of 581 ft.

The great extent of the deposits both laterally and in depth has permitted exploitation of the area on a large and very profitable scale. In the 1930's, following the abandonment by many countries of the gold standard, and the initiation by the United States of unlimited gold purchases, the ore was mined at a depth of 12,000 ft.; subsequently the deepest workings averaged

9000 ft. in depth. In the late 1960's the annual gold production in the Witwatersrand totaled more than 17,000,000 oz., or about 57 percent of the total gold production of South Africa. Coal and manganese also are mined in the region. Industrial establishments include the Germiston (q.v.) gold refinery, the largest in the world, foundries, engineering shops, and cement plants.

See GOLD: *Gold Production*; JOHANNESBURG; TRANSVAAL.

WOBURN, city of Massachusetts, in Middlesex Co., 10 miles N.W. of Boston. It is a residential and manufacturing center. Leather, leatherworking machinery, electronic equipment, and processed foods are produced in the principal industrial establishments. Woburn is the site of several fine colonial buildings, notably the Baldwin Mansion (1661), the home of the American engineer and army officer Loammi Baldwin (1740-1807), who developed the apple that bears his name. Baldwin also served as chief engineer of the Middlesex Canal (1803), the nearby remains of which still exist. Other features of the city include the birthplace of Benjamin Thompson (q.v.), the Anglo-American administrator and physicist who became Count Rumford of the Holy Roman Empire; and the Woburn Public Library, architecturally one of the most distinctive library buildings in the United States. The American inventor Charles Goodyear (q.v.) developed his rubber-vulcanizing process while a resident of the city. Woburn was settled in 1640 as part of the city of Charlestown (q.v.). It was incorporated as a town in 1642 and as a city in 1888. Pop. (1960) 31,214; (1970) 37,406.

WODEHOUSE, Sir P(elham) G(renville) (1881-1975), British-born American writer, born in Guilford, England, and educated at Dulwich College. He joined the staff of the London *Globe* in 1902 and from 1903 to 1909 edited the humorous "By the Way" column for that paper. His reputation as a humorous novelist was established with *Psmith in the City* (1910). He subsequently maintained his enormous popularity with a series of novels depicting amusing characters in absurd and intricate situations. Perhaps best known of his fictional creations, in addition to Psmith, are Bertie Wooster and his butler, the inimitable Jeeves. Wodehouse was also the coauthor of numerous musical comedies and plays, produced mostly in America, where he did much of his early writing. During the 1940's he was interned in Germany and made a series of radio broadcasts from Berlin; it was later emphasized that he had been a dupe

WÖHLER

of the Nazis and not, as had been widely believed, a collaborator. In 1955 he became an American citizen, and on New Year's Day, 1975, shortly before his death, he was made a Knight Commander of the Order of the British Empire.

Among his nearly one hundred novels are *Ven. Good Jeeves* (1930), *The Butler Did It* (1957), and *Bachelors Anonymous* (1974).

WÖHLER, Friedrich (1800–82), German educator and chemist, born in Eschersheim (now part of Frankfurt), and educated at the universities of Marburg and Heidelberg. While studying medicine, obstetrics, and surgery at Heidelberg, he became interested in chemistry and went to Stockholm to study with the Swedish chemist Baron Jöns Jakob Berzelius (q.v.). In 1836 he became professor of chemistry at the University of Göttingen.

One of the pioneers in the field of organic chemistry, Wöhler is famous for his synthesis of the organic compound urea (q.v.); see **CHEMISTRY: Organic Chemistry**. By this contribution he proved, contrary to contemporary scientific thinking, that a product of the living processes of animals could be made in the laboratory from inorganic materials. Wöhler also conducted important researches on uric acid and the oil of bitter almonds, in collaboration with the German chemist Baron Justus von Liebig (q.v.), and isolated aluminum and beryllium. He discovered calcium carbide and prepared acetylene

(q.v.) from it, and also developed the method for preparing phosphorus in common use today.

WOLCOTT, Oliver (1726–97), American Revolutionary patriot and soldier, born in Windsor, Conn., and educated at Yale College (now Yale University). He was the son of Roger Wolcott (1679–1767), who was governor of Connecticut from 1751 to 1754. After participating in 1747–48 in King George's War (q.v.), Oliver Wolcott practiced law in Litchfield, Conn. Elected a delegate to the Continental Congress in 1775, he was one of the signers of the Declaration of Independence (qq.v.). During the American Revolution (q.v.) he served with the Connecticut militia in several important campaigns. Wolcott was lieutenant governor of Connecticut from 1786 to 1796 and governor from 1796 until his death. His son Oliver Wolcott (1760–1833) was governor of Connecticut from 1817 to 1827.

WOLF, common name for the species of animal which, with the dogs and jackals, make up the genus *Canis*, and which typically live in the wild state. Wolves are characterized by powerful teeth, bushy tails, and round pupils of the eyes. Two species of wolves are recognized; the gray or timber wolf, *C. lupus*, widely distributed in North America, Europe, and Asia; and the red wolf, *C. niger*, which occurs only in the south-central United States. The timber wolf measures about 3½ ft. in length, excluding the tail, which measures less than half the body length. It is

North American wolf,
Canis lupus

Hugh M. Halliday -
National Audubon Society



red-yellow or yellow-gray, with black patches above and white below. The red wolf is similar in size but darker in color.

Although wolves are still abundant in eastern Europe and in Asia, they have become extinct in Great Britain, and their numbers in the New World have been greatly diminished. Wolves are equally at home on prairies, in forest lands, and on mountains. In the winter they travel in packs in search of food. Small animals and birds are the common prey of wolves, but a pack of wolves may attack bison, reindeer, sheep, and other large animals. When no live prey can be found, wolves will readily feed on carrion and vegetation.

The den, or lair, of the wolf may be a cave, a hollow tree trunk, a thicket, or a hole in the earth dug by the wolf. The breeding season is in the spring, with a litter comprising three to nine cubs. The cubs normally remain with the parents till the following winter, but may remain much longer. Wolves sometimes breed with large domesticated dogs, and sledge dogs are often cross-bred with wolves to improve the vigor of the stock. Wolves demonstrate extraordinary cunning in eluding traps.

WOLF, Friedrich August (1759–1824), German classical scholar, born in Hainrode, near Nordhausen, and educated at the University of Göttingen. In 1783 he became professor of philosophy at the University of Halle. There he championed intensive study of all phases of the life and thought of antiquity, laying the foundation for a modern, scientific approach to classical philology (q.v.). In 1807 during the Napoleonic Wars (q.v.), when the University of Halle was closed by the French, Wolf went to live in Berlin and helped found what is now the Humboldt University of Berlin in East Germany.

Wolf's name is most frequently associated with his *Prolegomena ad Homerum* ("Introduction to Homer", 1795), a treatise in which he advanced the theory, already suggested by others, that the Greek epics the *Iliad* and the *Odyssey* (qq.v.) are not the work of a single poet but rather collections of separate ballads or lays composed by different authors and pieced together by later editors. The *Prolegomena* provoked a controversy that overshadowed all other philological discussions of the 19th century; see HOMER: *Homeric Question*. Wolf's writings include critical editions of the works of the Greek classical writers Hesiod, Demosthenes, Lucian, and Plato, the Roman philosopher Cicero (qq.v.), and others.

WOLF, Hugo (1860–1903), Austrian composer, born in Windischgraz (now Slovenjgradec, Yu-

goslavia), and educated at the Vienna Conservatory. In 1884 he became a music critic for the *Salonblatt*, a Viennese magazine. Beginning in 1887 he devoted himself wholly to musical composition and study. In 1897 he became mentally ill and passed most of the remainder of his life in an institution.

Wolf, who brought the art of German lieder (see SONG) to new heights of subtlety and complexity, achieved in his nearly 300 songs a striking synthesis of poetic and musical elements. He used for his texts works of eminent German poets, including Eduard Mörike (1804–75), Joseph von Eichendorff (1788–1857), and Johann Wolfgang von Goethe (q.v.). His *Spanisches Liederbuch* (1891) and *Italienisches Liederbuch* (vol. 1, 1891; vol. 2, 1896) contain songs set to German poems with Spanish and Italian themes. He also composed three songs (1897) to texts by the Italian Renaissance artist and poet Michelangelo (q.v.). Wolf's few works in other forms include a String Quartet (1879–80), the *Italienische Serenade* (1892), and the opera *Der Corregidor* ("The Governor", 1895).

WOLFE, James (1727–59), British soldier, born in Westerham, Kent, England. He entered the army at the age of fourteen and served with distinction throughout the War of the Austrian Succession (1740–47) and the Scottish campaign of 1746 against the pretender to the British throne, Charles Edward Stuart (see under STUART); see SUCCESSION WARS: *War of the Austrian Succession*. In 1757 the British secretary of state William Pitt (see under PITT) made Wolfe second in command under the British army officer Jeffrey Amherst (q.v.) in the French and Indian War (q.v.). Wolfe's competence in the siege and capture of the French fortress of Louisburg, Nova Scotia, in 1758, earned him promotion to major general and the command of a military and naval expedition against Québec.

In June, 1759, he sailed up the Saint Lawrence R. with about 9000 troops and encamped above the city. Baffled by the inactivity of the French defenders, he launched a frontal attack on their entrenched positions on July 31. The attack was unsuccessful, and Wolfe's brigadiers counseled a landing on the north shore of the St. Lawrence. On the night of Sept. 12 Wolfe moved about 5000 of his men downstream to a landing point about 1.5 miles s.w. of Québec. Scaling a steep cliff to the Plains of Abraham (q.v.) above Québec, the British troops forced the French into an open battle early on Sept. 13 and decisively defeated them. Wolfe, however, was killed, and the French commander, Marquis Louis Joseph de Montcalm de Saint-Veran (q.v.),

WOLFE, THOMAS CLAYTON

died the next day. See CANADA: *History: Anglo-French Struggle for North America.*

WOLFE, Thomas Clayton (1900–38), American writer, born in Asheville, N.C., and educated at the University of North Carolina and Harvard University. After a brief sojourn abroad, he served from 1924 to 1930 as an English instructor at New York University in New York City. His first novel, *Look Homeward, Angel* (1929), was an immediate success, enabling Wolfe to devote himself wholly to writing. Strongly autobiographical in content and marked by an almost overwhelming emotional intensity, *Look Homeward, Angel* exhibits the stylistic influence of the American novelists Theodore Dreiser and Sinclair Lewis and of the Irish writer James Joyce (qq.v.). A sequel, *Of Time and the River*, was published in 1935. *The Web and the Rock* (1939) and *You Can't Go Home Again* (1940) completed Wolfe's cycle of autobiographical novels. The central theme of the cycle is the search by an idealistic young man for enduring values. Despite the corruption he finds in the society around him, he retains his poetic faith in the es-



Right: Thomas Wolfe; Below: Wolfe's home, preserved as a memorial at Asheville, N.C. State of North Carolina



sential goodness of the American people and the greatness of their land. Wolfe's writing is characterized by a fervent lyricism, which has been compared to that of the American poet Walt Whitman (q.v.). He wrote unrestrainedly and at great length; his works had to be edited drastically for publication. These novels had an enormous impact on the readers of Wolfe's own generation. They appealed less to the young people of the post-World War II era, although they continued to be read and studied.

His other works include *From Death to Morning* (1935), a collection of short stories; *The Story of a Novel* (1936), a critique of his own methods of composition; *The Hills Beyond* (1941), containing an incomplete novel and shorter pieces; *Western Journal* (1951); and *Writing and Living* (1964).

WOLFF, Baron Christian von or WOLF, Baron Christian von (1679–1754), German philosopher and mathematician, born in Breslau (now Wrocław, Poland), and educated at the University of Jena. In 1706 he became professor of mathematics and natural philosophy at the University of Halle. Wolff's rationalist doctrines gradually came into sharp conflict with the religious views of some of his faculty colleagues. In 1721 he delivered a lecture in which he cited the moral axioms of the Chinese philosopher Confucius (q.v.; see also CONFUCIANISM) as proof that human reason could attain moral truth by its own efforts. As a result, he was banished from Prussia in 1723 on grounds of atheism and fatalism. He went to Hesse and taught at the University of Marburg until 1740. In that year Frederick II (q.v.), King of Prussia, recalled him to Halle, where, in 1743, he became chancellor of the university.

Wolff's philosophy is a modification of the philosophic system developed by the German thinker Baron Gottfried Wilhelm von Leibniz (q.v.). Although he was not an original thinker, Wolff was important as an organizing and systematizing philosopher. His voluminous writings include *Vernünftige Gedanken von Gott, der Welt, und der Seele des Menschen* ("Rational Thoughts on God, the World, and the Souls of Men", 1719).

WOLF-FERRARI, Ermanno (1876–1948), Italian composer, born in Venice, and trained privately in Munich. His first opera, *Cenerentola* ("Cinderella", 1900), was not well received in his native country, and thereafter most of his works were performed in Germany. From 1902 to 1907 he was director of the Liceo Benedetto Marcello, the conservatory of Venice. His comic opera *Le Donne Curiose* ("The Inquisitive

Women", 1903) brought him international fame when it was produced at the Metropolitan Opera House, New York City, in 1912. Of his thirteen operas, most of which are musically complex versions of classical comedies, the most successful have been *I Quattro Rusteghi* ("The Four Country Bumpkins", 1906), *Il Segreto di Susanna* ("The Secret of Suzanne", 1909), and *I Gioielli della Madonna* ("The Jewels of the Madonna", 1911), an operatic melodrama in the Italian *verismo* style. See ITALIAN MUSIC; OPERA. **WOLFHOUND.** See BORZOI; IRISH WOLFHOUND. **WOLFRAM.** See TUNGSTEN.

WOLFRAMITE, opaque mineral composed of ferrous and manganous tungstate, $(\text{Fe}, \text{Mn})\text{WO}_4$, and existing as an isomorphous mixture of the minerals ferberite, FeWO_4 , and hübnerite, MnWO_4 . It crystallizes (see CRYSTAL) in the monoclinic system, exhibits perfect cleavage, and shines with a submetallic to resinous luster. The color ranges from black, streaked with brown, to brown, streaked with black. It has a hardness (q.v.) of 5.0 to 5.5 and of 7.0 to 7.5. Wolframite occurs in combination with such minerals as cassiterite, scheelite, quartz, pyrite, galena, sphalerite, and arsenopyrite, and is found mainly in mainland China; Burma; New South Wales State, Australia; Bolivia; Czechoslovakia; East Germany; and Cornwall, England. In the United States principal deposits occur in Boulder Co., Colorado; Nye Co., Nevada; and the Black Hills, South Dakota. The principal use is as a source of tungsten (q.v.), or wolfram.

WOLFRAM VON ESCHENBACH (about 1165–1220?), German epic poet, born in Eschenbach (now Wolframs-Eschenbach), near Ansbach, Franconia. Little is known of his life other than that he was a knight and, for a time, a minnesinger (see MINNESINGERS) at the court of Hermann I, Landgrave of Thuringia (d. 1217). Wolfram's reputation as the greatest poet of medieval Germany rests largely upon his *Parzival*, an epic of the Holy Grail; see GRAIL, THE HOLY. Approximately 25,000 lines long, it was completed about 1210. Some literary critics believe it is based on *Perceval le Gallois* by the French poet Chrétien de Troyes (q.v.), but others hold that the two works are independent. *Parzival* was the source for the libretto of the opera *Parsifal* (1882) by the German composer Richard Wagner (q.v.). Wolfram himself figures as a leading character in Wagner's earlier opera *Tannhauser* (1845). Wolfram's highly individualistic writings are distinguished by an intense spirituality and by a religious tolerance rarely found in the works of his contemporaries. He was one of the first poets to use symbolism.

WOLLASTON

Other works by Wolfram are the epics *Willehalm* and *Titurel*, both incomplete, and *Wachter Lieder* ("Songs of the Watchman"), a group of love poems.

See GERMAN LITERATURE: *Middle High German Period* (1100–1370).

WOLLASTON, William Hyde (1766–1828), British chemist and physicist, born in East Dereham, England, and educated at Caius College, the University of Cambridge. After practicing as a physician in Bury St. Edmunds and London from 1795, he confined himself to research work when he became partially blind in 1800. His main fields of research were electrochemistry and optics, and he is credited with the discovery of palladium and rhodium and with a method of making platinum malleable. Wollaston also made many valuable observations on the refraction of light and invented an apparatus for measuring the refractive power of solids. He studied the solar spectrum and ultraviolet radiation. His most valuable inventions were the camera lucida, a double-image prism that has since proved indispensable in microscopic work, and the reflecting goniometer, an apparatus used for determining the geometrical form of crystals. The mineral wollastonite (CaSiO_3), which is used primarily as a filler in such manufactures as paint and paper, was named after Wollaston.

WOLLONGONG, city of Australia, in New South Wales, extending for more than 25 mi. along the coast of the Tasman Sea E. of the Illawarra Range, centered about 40 miles S. of Sydney. Included in the greater city are several urban centers lying in an area of coal mining and dairying, and many beach-resort areas. Port Kembla is a deep-sea port and industrial center producing iron, steel, and coke; Bulli and Woonona are coal-mining towns; and Thirroul is a rail-yard center. Bricks, textiles, apparel, and food products are also manufactured. Wollongong University College is in the city. Views of the entire coastal region may be had from Mts. Kembla and Keira. Settled in 1815, Wollongong was established as a town in 1834 and as a municipality, the first in Australia, in 1859. In 1947 the various centers were amalgamated, creating an area of 276 sq.mi. Pop. of city (1971) 160,902; pop. of greater Wollongong (1971) 185,890.

WOLLSTONECRAFT, Mary. See under GODWIN.

WOLSEY, Cardinal Thomas (1475?–1530), English statesman and prelate, born in Ipswich, and educated at the University of Oxford. He was ordained a priest in 1498 and was made

chaplain to the English king Henry VII (q.v.) in 1507. With the accession of the young Henry VIII (q.v.) to the English throne in 1509, Wolsey began to acquire great power and wealth. He received his first major secular appointment in 1511, when he was made a privy councillor. In 1513 he assisted in planning and carrying out



Thomas Wolsey (engraving from a portrait by the contemporary German painter Hans Holbein the Younger).

the highly successful English invasion of France, and in the following year he secured a peace with France. By the time he was made lord chancellor of England in 1515, he already virtually controlled both foreign and domestic affairs for Henry.

Wolsey raised royal authority in England to a new height, but in doing so he incurred many enemies. In the popular mind, Wolsey, as the executor of policy, was responsible for the imposition of heavy taxes to pay for wars. He also was unpopular with Parliament and the nobility because of his power over the king and his ostentatious displays of wealth at a time when there was increasing resentment against the clergy. In affairs abroad Wolsey attempted to make England arbiter of the struggle for power between Francis I, King of France, and Charles V (qq.v.), Holy Roman Emperor. Wolsey played the two rivals against each other, giving England the balance of power in Europe until 1529, when

Francis and Charles made peace with each other.

Wolsey also rose rapidly in the church, becoming bishop of Lincoln and archbishop of York in 1514, a cardinal in 1515, and a papal legate in 1518. After being made a legate for life in 1524, he wielded power over the church in England comparable to his secular power as chancellor. He aspired to the papacy and made an alliance with Charles for his support in two papal elections. The emperor did not keep his word, however, and Wolsey never achieved his highest aim.

At the height of his power, Wolsey fell, largely because he failed to secure a prompt annulment of Henry's marriage to Catherine of Aragón, so that the king could marry Anne Boleyn (qq.v.). In 1528 Pope Clement VII (see under CLEMENT) appointed Wolsey and the Italian papal legate Lorenzo Campeggio (1474?-1539) to hear Henry's suit in England. Campeggio was recalled to Rome by the pope in July, 1529, and Wolsey was forced to appeal directly to Rome. The pope, dominated by Charles V, who was Queen Catherine's nephew, refused to sanction the divorce. **Wolsey's Trial and Conviction.** In 1529 Wolsey's enemies succeeded in having him tried and convicted of violating an old law against holding a foreign court in England. Divested of all his official posts and honors except for the archbishopric of York, to which he retired, Wolsey was subsequently charged with treason and ordered to London. Illness forced him to stop on the way and he died in Leicester Abbey.

Although arrogant and immoderately ambitious, Wolsey proved himself to be an able and just administrator and succeeded in his aim of making England a leading power. Also a patron of learning, he founded a college (now Christ Church) at the University of Oxford.

See ENGLAND: *History: The Henrician Reformation*.

WOLVERHAMPTON, Great Britain, county borough of Staffordshire, England, 13 miles N.W. of Birmingham. It is an industrial center, with factories engaged in the manufacture of iron and steel, tin plate, locomotives, machinery and tools, automobiles, aircraft, electrical equipment, chemicals, and locks. Points of interest include the Church of Saint Peter, dedicated in 994 and rebuilt several times, notably in the 13th and 15th centuries; the free grammar school, founded in 1512; and the town hall. Wolverhampton developed around the Church of Saint Mary, established about 996 by Wulfruna, sister of King Edgar (q.v.). The Wednesday market and annual fair date from 1258. Wolver-

hampton was incorporated as a county borough in 1888. Pop. (1971) 268,847.

WOLVERINE, carnivorous mammal, *Gulo gulo*, of the northern regions of North America, Europe, and Asia. It belongs to the Weasel family, Mustelidae, but has much in common with the badger. The body is heavy set, and the legs are short and thick; the claws are long and curved. The head and tail are carried low and the back forms a high arch. The snout is short and pointed, and the head blunt and rounded; the eyes are set widely apart, and the ears project but little above the head fur. The tail is short and extremely bushy, the individual hairs being 6 to 8 in. in length. The thick body fur is composed of long glossy hairs; it is dark brown except for a lighter stripe running the entire length of each side. The average length of the body, excluding the tail, is 2½ ft. French Canadians call this animal the carcajou and the British Americans call it the quickhatch. In Europe the animal is called the glutton. The wolverine is a sylvan animal, ranging north to the Arctic Circle and south to the northern border of the United States. It also occurs in the Sierra Nevada Mts. of California. It is nocturnal in habits, and does not hibernate. In spite of its seemingly clumsy movements, the wolverine can move swiftly; the animal usually travels alone or in pairs. The young are born from February through May, usually two or three to a litter. Wolverines will eat any animal they can kill, and, lacking live prey, will eat carrion. They are very adept at robbing the traps that hunters set for other animals. Although once abundant, the wolverine is now quite rare, as the Indians and Eskimo of northern Canada hunted it extensively for its frost-resistant fur.

WOMAN'S CHRISTIAN TEMPERANCE UNION. See NATIONAL WOMAN'S CHRISTIAN TEMPERANCE UNION.

WOMAN SUFFRAGE, right of women to share on equal terms with men the political privileges afforded by representative government and, more particularly, to vote in election contests and referendums and to hold public office. Equal political rights for women have been advocated since antiquity. Under the autocratic forms of government which prevailed in ancient times and under the feudal regimes of the Middle Ages, however, suffrage was so restricted, even among men, that enfranchisement of women never attained the status of a major political issue. Conditions warranted organized woman-suffrage movements only after suffrage had been won by large, formerly disenfranchised groups of the male population as a con-



Susan B. Anthony and Elizabeth Cady Stanton, leaders of the American woman's suffrage movement in the 19th century.

sequence of the democratic revolutions of the 18th and 19th centuries.

In Colonial America. The modern woman-suffrage movement originated in post-Revolutionary America. Even before the Revolution American women participated in public life somewhat more freely than European women. In 1647 a wealthy Maryland landholder named Margaret Brent attempted, boldly but unsuccessfully, to secure "place and voice" in the legislature of the colony. In Massachusetts women property holders voted from 1691 to 1780. The Continental Congress (q.v.) debated the woman-suffrage question at length, deciding finally that the individual States should formulate voting rules. In addition many groups, such as the American Quakers, and numerous individuals, notably the American patriot Thomas Paine (q.v.), consistently advocated the enfranchising of women.

Nonetheless, in colonial and early-19th century America, as elsewhere in the world, women commonly were regarded as inferior beings. Their children, property, and earnings belonged by law solely to their husbands, and various legal and social barriers made divorce almost unthinkable. In most respects American women were legally on a par with criminals, insane persons, and plantation slaves.

Abolitionism and Temperance. During the first half of the 19th century American suffragists worked mainly through the abolitionist

and the temperance movements, but antifeminist prejudices severely limited the role of woman members. A notable instance of such prejudice occurred at the London Anti-Slavery Convention of 1840. For several days the convention debated bitterly the right of eight American women to take part in the proceedings. Internationally famous clergymen contended during the debate that equal status for women was contrary to the will of God. Eventually two of the women, the noted American feminists Lucretia Coffin Mott (see under MOTT) and Elizabeth Cady Stanton (q.v.), were seated behind a curtain, effectively shielded from view and denied the right to speak.

After many such rebuffs American suffragists decided to create a separate movement dedicated to women's rights. Prominent early in the movement were, besides Lucretia Mott and Elizabeth Stanton, the brilliant American feminists Susan Brownell Anthony, Lucy Stone (qq.v.), Abby Kelley Foster (1810-87), Martha Wright, Mary Anna McClintock and Ernestine B. Rose. Male Americans active in support of woman suffrage included the clergymen Henry Ward Beecher (see under BEECHER) and Wendell Phillips and the essayist and poet Ralph Waldo Emerson (qq.v.).

The Seneca Falls Convention. In July, 1848, on the initiative of Mrs. Mott and Mrs. Stanton, the first women's rights convention met at a Wesleyan church chapel in Seneca Falls, N.Y. More

more than one hundred persons attended the convention, among them many male sympathizers. After serious discussion of proposed means to achieve their ends, the delegates finally agreed that the primary goal should be attainment of the franchise. The convention then adopted a "Declaration of Sentiments" patterned after the American Declaration of Independence.

Public reaction to the Seneca Falls convention presaged a stormy future for the new movement. Though many prominent Americans, including the famed editor Horace Greeley and the abolitionist leader William Lloyd Garrison (qq.v.), warmly supported it, many citizens and the great majority of newspapers responded with ridicule, fury, and vilification. Suffragists were called "the shrieking sisterhood", branded as unfeminine, and accused of immorality and drunkenness. Later, when suffragist leaders undertook speaking tours in support of women's rights, temperance, and abolition, they were subjected often to physical violence. Meetings repeatedly were stormed and disrupted by gangs of street bullies. On one occasion when Miss Anthony spoke in Albany, N.Y., the city mayor sat on the rostrum brandishing a revolver to discourage possible attacks by hoodlums in

the audience. Despite intimidation, the woman-suffrage and abolitionist movements continued for some years to grow side by side.

After the Civil War. Bitter disagreements over strategy engendered a schism between the suffragist and abolitionist groups after the Civil War. Many male abolitionists voiced fears that the demands of women suffragists might impede the campaign to gain voting rights for male ex-slaves. The issue came to a head in 1868, when the abolitionists pressed for a Constitutional amendment enfranchising all Americans regardless of race, creed, or color. Suffragists quickly complained that the proposed amendment made no mention of women. The abolitionists answered that the suffragists should defer their claims rather than endanger passage of the amendment. To many suffragists, notably Mrs. Stanton and Miss Anthony, postponement was unacceptable. In May, 1869, the two feminist leaders created the independent National Woman Suffrage Association, with the objective of securing enactment of a Federal woman-suffrage law. Another suffragist faction,

Members of a woman-suffrage parade in New York City in 1917. New York State granted women the vote later that year. UPI



WOMAN SUFFRAGE

led by Lucy Stone and Henry Ward Beecher, countered in November of the same year by founding the American Woman Suffrage Association. The latter group worked for gradual adoption of woman suffrage on a State-by-State basis. The Territory of Wyoming gave women the suffrage in 1869.

After the passage (1870) of the Fifteenth Amendment to the Constitution of the United States (q.v.), Miss Anthony interpreted the law as enfranchising American women as well as male ex-slaves. She went to the polls in Rochester, N.Y., in 1872 and persuaded the election inspectors to let herself and twelve women friends register and vote. Two weeks after the election she, her twelve friends, and three of the election inspectors were arrested. Miss Anthony received a grossly unfair trial, during which the judge repeatedly displayed antifeminist prejudices. At the height of the proceedings the judge, anticipating apparently a jury verdict in her favor, dismissed the jury and imposed on her a fine of \$100. Miss Anthony stoutly refused to pay the fine, whereupon the judge, apprehensive that she might appeal to higher courts, allowed her to go free. Her friends never were brought to trial. The election inspectors received heavy fines, which were paid by sympathetic spectators. The case aroused widespread public interest, but the ban against woman suffrage remained.

Suffrage Gains. Susan Anthony's ordeal had the effect, however, of lending impetus to the feminist movement. In 1890 the Stanton-Anthony group merged with the Stone-Beecher faction to form the National American Woman Suffrage Association. For many years thereafter the association worked to advance women's rights on both the State and Federal levels. Besides Lucy Stone, Susan Anthony, and Elizabeth Stanton, leaders and supporters of the association included the noted American feminists Harriet Beecher Stowe, Julia Ward Howe, Clara Barton, Jane Addams, and Carrie Chapman Catt (qq.v.). Largely as a result of agitation by the association, suffrage was granted in the States of Colorado (1893), Utah and Idaho (1896), and Washington (1910). In addition, the association in 1910 secured 500,000 signatures for a petition urging Federal woman-suffrage legislation. California granted women the vote in 1911, Kansas, Oregon, and Arizona followed in 1912, Nevada and Montana in 1914, and New York in 1917.

The American suffragist movement scored its climactic victory shortly after World War I. In 1919 Congress approved the Nineteenth Amendment to the Constitution, which provided that

"The right of citizens of the United States to vote shall not be denied or abridged by the United States or by any State on account of sex." Later ratified by thirty-six State legislatures, the Nineteenth Amendment became the law of the land on Aug. 26, 1920. See also LEAGUE OF WOMEN VOTERS OF THE UNITED STATES.

British Suffrage Movement. In Great Britain the woman-suffrage movement roughly paralleled that of the United States, but in its later stages more vigorous and violent tactics were employed.

The great pioneer figure of British feminism was the writer Mary Wollstonecraft (see under GODWIN), her chief work, *Vindication of the Rights of Women* (1792), is one of the major feminist documents of the 18th century. During the 1830's and 1840's British suffragism received notable aid and encouragement from the Chartists (see CHARTISM), who fought unsuccessfully for a sweeping program of human rights. In subsequent years the woman-suffrage issue was kept before the British public by a succession of liberal legislators, among them the statesmen and social philosophers John Stuart Mill (see under MILL), John Bright, and Richard Cobden (qq.v.). Mill helped to found in 1865 the first British woman-suffrage association. All efforts to secure the franchise for women were effectively opposed. Prominent among the antifeminists of the period were the reigning monarch Queen Victoria and the British prime ministers William Ewart Gladstone (qq.v.) and Benjamin Disraeli (see under DISRAELI).

The British woman-suffrage movement acquired additional impetus when in 1897 various feminist groups merged to form the National Union of Woman Suffrage Societies. A section of the membership soon decided that its policies were timid and indecisive, and in 1903 the dissident and more militant faction, led by the colorful feminist Emmeline Pankhurst (q.v.), established the Women's Social and Political Union. Mrs. Pankhurst's suffragettes soon won a reputation for boldness and militancy. Tactics employed by the organization included boycotting, bombing, window breaking, picketing, and harassment of antisuffragist legislators. In 1913 one dedicated suffragette publicized her cause by deliberately hurling herself to death under the hoofs of horses racing in the derby at Epsom Downs. Because of their forceful and provocative behavior, the suffragettes often were manhandled by the police and repeatedly were jailed and fined.

During World War I the British suffragists ceased agitation and made notable contribu-



Marchers in New York City support the women's liberation movement in 1970. Today's feminists seek such rights as equal job opportunity.

Wide World

tions to recruiting drives and other aspects of the war effort, favorably influencing public opinion. In 1918 Parliament enfranchised all women householders, householders' wives, and women university graduates over thirty years of age. Parliament lowered the voting age of women to twenty-one in 1928, giving them complete political equality with men. In 1929 the British trade union leader Margaret G. Bondfield (1873–1953) became the first woman cabinet member in British history.

Suffrage in Other Countries. Meanwhile and subsequently most of the other nations of the world, with significant exceptions, enacted woman-suffrage legislation. Among the first to do so were the following, each of which granted the franchise to women before the middle of the 20th century: New Zealand (1893); Australia (1902); Finland (1906); Norway (1913); Denmark (1915); the Netherlands and Soviet Union (1917); Canada and Luxembourg (1918); Austria, Czechoslovakia, Germany, Poland, and Sweden (1919); Belgium (partial, 1919; full, 1948); Ecuador (1929); Union of South Africa (1930); Brazil and Uruguay (1932); Turkey and Cuba (1934); France (1944); Italy and Japan (1946); China and Argentina (1947); South Korea and Israel (1948); and Chile, India, and Indonesia (1949). By 1970, 121 countries had granted women the right to vote.

Women's Rights. With the widespread extension of the franchise to women, the women's-rights movement broadened its scope during the 20th century. Among the rights sought currently by feminist groups throughout the world are the right to serve on juries, the right to retain earnings and property after marriage, the right to retain citizenship after marriage to an alien, and the right to equal pay and equal job opportunity. In the late 1960's so-called women's liberation movements were organized and became active. *See WOMEN'S RIGHTS.*

WOMB. *See UTERUS.*

WOMBAT, common name applied to burrowing marsupials (q.v.) of the family Phascolomidae, native to Australia and Tasmania. Of the three known species, the common wombat of southern Australia is the largest, attaining a maximum length of 3 ft. It is tailless and stocky, and has thick, coarse fur that varies in color from yellow to black. In structure and gait it resembles a miniature bear (q.v.). The teeth are of continuous growth, and, as in rodents, there is a single pair of chisel-like incisors in each jaw. The common wombat has long claws adapted for digging and lives in burrows, from which it emerges at night to feed on grasses and other



Wombat, family Phascolomidae

R. Van Nostrand
National Audubon Society

plant substances. It has a placid disposition and is easily domesticated. Another species confined to southern Australia is the hairy-nosed wombat, which differs from the common species in having longer, pointed ears, a hairy muzzle, and soft, silky fur.

The wombat of Tasmania is the smallest species, and is known locally as a badger. The pelt is extremely coarse and, being very durable, is used extensively by Tasmanians for floor mats and rugs. The flesh, reputedly similar in flavor to pork, is esteemed as food.

The young of each species, born singly once a year, is carried in the mother's pouch for about six months.

WOMEN, EMPLOYMENT OF. Women have been economically important to society since prehistoric times although their contributions have varied according to the structure, needs, customs, and attitudes of the society in which they lived.

Women's Economic Role in Antiquity. In preagricultural and agricultural communities the home was largely a self-sustaining economic unit. Much of the work that in modern times is done in factories, food-processing plants, hospitals, and schools was done by women in the home. In addition, women often shared the work of tilling the land and caring for farm animals. For this they received no payment, except as they shared in the general family holdings.

The history of women as paid workers is almost equally long. The Old Testament records, "She maketh fine linen, and selleth it; and deliv-

ereth girdles unto the merchant" (Prov. 31:24). In Babylonia (q.v.) about 2000 years before the birth of Christ, women were permitted to engage in business and to work as scribes. In this respect Babylonia was exceptional because in ancient times labor was usually done by slaves. Moreover, women were considered hardly more than chattels. Those of the upper classes were usually confined to their homes, and the working women were either plebeians or slaves used in hard unskilled labor.

Women Workers in Medieval and Post-medieval Europe. It has always been customary for artisans working in their own homes to exploit the labor power of their families. This custom was so prevalent during the Middle Ages that it was not unusual for the craft guilds (see GUILD) of the period, including even some that otherwise excluded women, to admit to membership the widows of guild members provided that they met the other membership requirements. Some of the early guilds barred women from membership and others accepted them only on a limited basis, but in 13th- and 14th-century England and France they frequently were accepted equally with men. Among such guilds, at least in some towns, were those of the tailors, barbers, carpenters, and saddlers and spurriers. Dressmaking and lace-making guilds were composed exclusively of women.

By the end of the 15th century the power of the guilds had begun to decline. They gradually were replaced by the putting-out system,

whereby large lots of tools and materials were distributed to workers by merchant-businessmen and the workers produced articles on a piecework basis in their homes. Some of these workers were women, who were paid directly for their work, and, as in the past, men with families were commonly helped by their wives and children.

During the 18th and early 19th centuries as the industrial revolution (q.v.) developed, the putting-out system gradually disappeared. Goods that traditionally had been produced by hand in the home were manufactured by machine in factories. In these early textile mills and clothing factories, women formed a large part of the working force.

American Working Women. In colonial America most women continued to make their economic contribution in the home, and the few who sought outside employment had a very limited choice of occupations. They were employed most frequently as teachers, domestic servants, and in various family enterprises. A few kept taverns or inns. Some did sewing and sold their services or products. Occasionally widows who had assisted their husbands took over the operation of a family business.

Paid employment for American women continued to be scarce until the establishment of textile factories. The first cotton factory in the country was built in Waltham, Mass., in 1814. Thereafter large numbers of women were hired for millwork. By 1850 the manufacture of clothing, shoes, cigars, and other products was providing employment in mills and factories for more than 200,000 women. Also during this time, the homework system, similar to the putting-out system of the late Middle Ages, became widespread and many more women were gainfully employed in home manufacturing enterprises.

By 1890 there were nearly 4,000,000 working women in the United States, or about 18 percent of the female population aged fourteen and over. This was about 17 percent of the total work force of that year. It consisted predominantly of young women, half of whom were under twenty-five years of age and about seven out of ten of whom were single. About half were in domestic and personal service; more than 20 percent were teachers or worked in clothing and textile plants; and another 20 percent worked on farms. Only about 5 percent of the working women were secretaries, clerks, or saleswomen.

Modern Trends. Industrial expansion, urbanization, improved transportation facilities, and

the growth of public education engendered a marked change in the working status of American women. As industry became more diversified and women acquired the necessary training, the scope of their industrial activity broadened. More complex industrial organization also resulted in more clerical jobs for women. By 1920 stenography and typing ranked among the four principal occupations. Correspondingly, farming occupations became less important, and by 1930 farming had disappeared from the list of the top ten occupations for women.

World Wars I and II accelerated the entrance of women into new occupations. At the end of each war, however, the number of employed women declined temporarily as few women could be retained on the jobs they had taken over. The decline was short-lived. Between 1950 and 1975 the number of working women almost doubled, while that of men rose by only one fourth.

Current Labor Force in the United States. Today more American women are holding paid jobs of greater diversity than ever before. In the mid-1970's about 34,000,000 women, aged sixteen years and over, were employed; about another 3,500,000 were temporarily unemployed. This total was approximately 40 percent of the entire labor force in the country, as compared with 15 percent in the 1870's.

Although women were represented in all fields of labor, in the mid-1970's the greatest number were concentrated in relatively few occupations: those of clerical worker (about 35 percent), service worker outside the private house (about 18 percent), professional and technical worker (about 15 percent), and operative (11 percent). Even within these different general fields, women tended to be limited to certain kinds of work. Of the more than 5,500,000 women classified as professional, technical, and kindred workers, more than 40 percent were noncollege teachers and 26 percent were medical and other health workers, mainly professional nurses. A significant number employed as operatives worked in the textile and clothing industries. Fewer were employed in the food and electrical industries. Relatively small numbers of women were to be found in other occupations: those of sales workers (about 7 percent), nonfarm managers and distributors (about 5 percent), private household workers (about 3 percent), nonfarm laborers (about 1 percent), farm laborers and supervisors (about 1 percent), and transport equipment operators (less than 1 percent). The rate of unemployment was generally higher for nonwhite women.

WOMEN, EMPLOYMENT OF

The relationship between education and occupation appears closer for women than for men. In the mid-1970's women who had completed only elementary school were most likely to be employed as operatives (skilled or semi-skilled employees in industry) or in service work. Of the working women who were secondary- or high-school graduates but had no college training, more than 60 percent were clerks or saleswomen. In the college-graduate category of employed women, approximately 70 percent were professional or technical workers, about 15 percent were clerks, and 6 percent were managers, proprietors, and executives.

Women overwhelmingly dominated certain occupations. In recent years they constituted the great majority of nurses and telephone operators. They made up 99 percent of the total number of secretaries, typists, and stenographers in the country; 71 percent of all teachers, excluding those at the college level; and 97 percent of private-household workers. In contrast, only about 6 percent of all farmers and farm managers and only 5 percent of all craftsmen and kindred workers were women.

The U.S. Bureau of Labor Statistics has estimated that in the mid-1970's more than 4,600,000 working women (about one in eight) were members of labor unions, providing more than 20 percent of the total union membership.

Women's earnings typically were lower than those of men. In the mid-1970's the median earnings of year-round, full-time women workers were about \$8000 as compared with about \$13,000 for men. The proportional gap between them was much less than it had been in the 1950's but was still considerable. Also, the rate at which the gap had been lessening slowed down. One reason for the disparity between men's and women's earnings is that women are not largely represented in high-level jobs, even in such fields as social work, library work, and teaching, in which they greatly outnumber men. It is a much disputed question whether their advancement has been hindered primarily by male unwillingness to face female competition or by their own reluctance to put the responsibilities of an important job before their families. Another reason for the disparity is that even when women do the same kind of work at the same level as men, they are frequently paid less than their male counterparts. (See following section for discussion of equal-pay legislation.)

The character of the female labor force has changed startlingly since the end of the 19th century. At that time it was composed largely of girls. In the mid-1970's one half of the force was

at least thirty-five years old and almost three fifths were married. The average young woman in the U.S. might expect to be employed for a few years after leaving school, to marry at the age of twenty-one, and to leave the labor market prior to the birth of her first child, about a year later. Her last child would probably be born when she was thirty years old, and if she resumed work at about thirty-five years of age, she could expect to work for another twenty-four years. Her life pattern is thus markedly different from that of a woman of the 19th or early 20th century. Among the factors that have contributed to this change are increased urbanization, greater longevity, marriage and childbearing at a comparatively early age, smaller-sized families, and broader educational and employment opportunities.

Most women work because they must support themselves and, in many instances, such dependents as children or parents. In the mid-1970's about 3,700,000 women workers were the heads of families, and more than three fifths of them were the only wage earners. In husband-wife families about 1,400,000 women were the only workers in the family. Of the 20,367,000 married women workers, many were working to supplement a spouse's income. About 15 percent of these women had husbands with salaries below \$5000, and about another 11 percent had husbands with income between \$5000 and \$7000 per annum. Women whose husbands had incomes above \$7000 frequently worked to provide increased comfort for their families or to ensure savings that would otherwise be impossible. In recent years a significant number of married women have entered the labor force for noneconomic reasons. The task of running a household has been facilitated by modern appliances and aids such as convenience foods, and many women choose to work primarily for the satisfaction derived. This is frequently the case among college-educated women who want to use their academic training after marriage.

Legislation Affecting Women Workers in the United States. Early legislation regulating the conditions of women's work was designed to protect women against exploitation and to safeguard their health and welfare. During the early industrial period, the average factory working day was thirteen or fourteen hours. By the 1820's agitation for a ten-hour day was widespread. In 1847 the first State law establishing ten hours as the standard work day, but permitting employee and employer to contract for longer hours, was passed in New Hampshire. Similar laws, applicable to men and women and usually covering

manufacturing and mercantile establishments only, were passed in 1853 by Maine, New Jersey, Pennsylvania, and Rhode Island. The first ten-hour law specifically applicable to women was passed by Ohio in 1852. Despite these laws employers' pressure upon employees to contract for additional work kept the average working day at about twelve and a half hours. Massachusetts became the first State to enforce a ten-hour law for women when, in 1879, the legislature amended a ten-hour law passed in 1874. Other States subsequently regulated women's hours of work by adopting enforceable laws, many of which limited the working day to eight hours. In 1968 forty-one States and the District of Columbia had laws regulating women's work hours.

Massachusetts established a commission in 1912 to determine minimum-wage schedules for women and children. Between that year and 1922, fourteen additional States, the District of Columbia, and Puerto Rico passed similar laws. The District of Columbia law was declared unconstitutional by the Supreme Court of the United States (q.v.) in 1923, and no further minimum-wage legislation was enacted until the 1930's. In 1937 the Supreme Court reversed the 1923 decision. The Fair Labor Standards Act (q.v.), a Federal minimum-wage law passed in 1938, applied to persons engaged in or producing goods for interstate commerce. This law has been amended periodically to extend coverage and increase the rate. By December, 1968, thirty-six States, the District of Columbia, and Puerto Rico had minimum wage laws chiefly applicable to workers in local trade and service industries. *See also* MINIMUM WAGE.

In the 19th century and the first quarter of the 20th century industry throughout the country discriminated against the relatively few women workers employed on so-called men's jobs by paying them wages substantially lower than the wages paid to men. The need for equal-pay laws was dramatically demonstrated during World War I, when large numbers of women entered war industries in jobs held traditionally by men. Michigan and Montana adopted equal-pay legislation in 1919, but almost twenty-five years elapsed before another State passed similar legislation. During World War II attention was again focused on the equal-pay problem. Between 1943 and April, 1969, thirty-one States passed equal-pay legislation. A Federal equal-pay act was passed in 1963 as an amendment to the Fair Labor Standards Act. Discrimination in employment based on sex was prohibited by the Civil Rights Act of 1964.

Certain occupations, especially mining, be-

lieved to be detrimental to women's health, safety, or well-being, are prohibited to them in various States. More than half of the States have laws prohibiting women's employment or limiting the conditions under which they may work in certain occupations or industries.

Household employment, which had declined until by the mid-1970's it accounted for only about 3 percent of women's occupations, used to be largely exempt from labor legislation. Only a few States regulated conditions of household employment in terms of minimum wages and maximum daily and weekly hours of work. In 1974 the Federal minimum wage law included domestic employees in its coverage for the first time.

Industrial homework is regulated in a number of States and in Puerto Rico. Several States and Puerto Rico have legislation prohibiting the employment of women for specific periods directly before and after childbirth. In Puerto Rico the working mother receives half of her pay during this time.

Other Federal laws that affect women in the labor force are the Walsh-Healey Public Contracts Act of 1936, the Wagner-Peyser Act of 1933, the Social Security Act of 1935 (see SOCIAL SECURITY), the Labor-Management Relations Act of 1947 (see NATIONAL LABOR RELATIONS ACT), and the Age Discrimination Act of 1967. The Women's Bureau of the United States Department of Labor (see LABOR, DEPARTMENT OF), established in 1920, is the Federal government agency principally concerned with the welfare of working women.

For labor legislation pertaining to both men and women, see HOURS OF LABOR; NATIONAL LABOR RELATIONS BOARD; UNEMPLOYMENT INSURANCE; WORKMEN'S COMPENSATION.

Women in the Labor Force of Other Countries. The extent and character of women's work vary according to the region and country. In urban, industrialized countries the pattern is similar to that of the U.S. According to International Labor Organization (q.v.) data, as countries become industrialized more women get jobs in more occupations. Nevertheless, they remain concentrated in a limited number of traditional occupations, many of which do not require high technical qualifications and most of which are low paid. In Great Britain, for example, the number of women in manual and non-manual occupations requiring intensive training has declined, whereas it has risen in those occupations in which little training is needed. In the Soviet Union, large numbers of women hold responsible positions in every occupation.

WOMEN IN THE U.S. ARMED FORCES

In the developing, agricultural countries of Africa, Asia, the Middle East, and Latin America, women are engaged chiefly in agricultural work, either on family holdings or as hired workers, or in related rural activities. Handicrafts and small industries are important occupations for women in such countries. Although there is some industrial employment of women in these countries, it is most frequently in unskilled work in the textile, food-processing, and tobacco industries. Women are working more frequently, however, in offices and in various professional and semi-professional fields, such as teaching, nursing, and public service. In African countries, for example, progress is being made in widening the work opportunities for girls and women. They still do not have the same access to education and training programs as males, however, especially in those skills necessary to a nation-building economy.

Women compose about a third of the world's labor force; about thirty out of every hundred women are economically active. In some countries women make up about two fifths or as much as half of the total work force (in the U.S.S.R., 50 percent; in eastern Europe, 42 percent; in Japan, 39 percent). In western Europe, northern Europe, and North America the proportion is roughly a third (in West Germany, about 37 percent). The total of married women in the labor force has sharply increased. In some countries more than half of the total female labor force is married. A tendency has also developed toward longer, uninterrupted work careers for women. When women do stop work for a time, they are increasingly apt to return at a later date. These trends have brought a related need for the development of facilities and services to ease the burden of working women, especially those with family responsibilities. Such services include child care and the retraining of older women who are returning to work after a long absence. Increasing emphasis is being placed on ensuring nondiscrimination against women in both training and employment, including equal pay for equal work and equal opportunities for promotion.

WOMEN IN THE UNITED STATES ARMED FORCES, enlisted and commissioned female personnel comprising an integral part of the U.S. Army, Navy, Marine Corps, and Air Force. In the past American women contributed to the armed services in a civilian capacity, chiefly as nurses and cooks. The Army and Navy created an official nurse corps in the early 20th century. During World War I a few women were admitted to the Navy and Marine Corps with military rank. Dur-

ing World War II, to free men for combat, large numbers of women formed separate military units attached to each service. The passage of the Women's Armed Services Integration Act in 1948 made each women's unit an integral part of the corresponding regular male force but placed restrictions on the rank women could attain, their length of service, and their numbers.

In 1967, Public Law 90-130 removed these disabilities. By the late 1970's, women entered the services, trained, received assignments and pay, and advanced according to their qualifications under essentially the same policies as men. Women were not permitted to engage in combat or undertake combat-related jobs, although the Department of Defense was urging a change in the law in order to fill combat posts. Most women served in communication, education, administration, and supply; more, however, were becoming technical specialists in such areas as weapons, fuels management, aircraft maintenance, police duty, and legal services. Under these improved conditions, the number of women in military service greatly increased from low post-World War II levels. In the mid-1970's they included more than 13,500 medical and line officers and more than 86,000 enlisted ranks. The government planned to increase the proportion of women in the military from about 5 percent to 11 percent.

Army. Women in Army service at first formed the Women's Army Auxiliary Corps (WAAC), created in 1942. The corps became part of the Army in 1943 as the Women's Army Corps (WAC), which reached its peak in 1945 with nearly 99,000 women serving at home and overseas. After World War II its numbers declined. Integrated into the regular Army in 1948, women were admitted to Reserve Officers Training Corps (R.O.T.C.) in 1973 and to West Point in 1976. The Army planned eventually to end the separate existence of the WAC, as the other services have already done with their women's units. In the mid-1970's more than 4700 women served as Army officers and nearly 39,000 as enlisted ranks.

Navy. Women first did naval service by enlisting as reservists in World War I. During World War II they were enlisted or commissioned in the reserve as Women Accepted for Volunteer Emergency Service (WAVES), but until 1944 they were restricted to duty in the U.S., Alaska, or Hawaii. In 1945 about 100,000 women were in service. The WAVES ceased to exist as a unit when they were integrated into the Navy in 1948, although the term is retained as an unofficial nickname. Women were admitted to Naval Reserve Officer Training Corps (N.R.O.T.C.) in

1973 and to Annapolis in 1976. In the mid-1970's female Navy personnel included more than 3500 officers and more than 18,000 enlisted ranks.

Marine Corps. Women first joined the Marine Corps as reservists in World War I. In World War II, more than 20,000 entered the Marine Corps Women's Reserve; they were called simply marines. Women became regular members of the Marine Corps in 1948 and in the 1970's began combat training. In the mid-1970's there were about 390 officers and 3000 enlisted personnel.

Air Force. Women have done air service since World War II, when more than 40,000, nicknamed Air WACs (Women's Army Corps), were assigned to the Army Air Force. In addition, a few women served as pilots in the Women's Auxiliary Ferrying Squadron (WAFS) and as Women Auxiliary Service Pilots (WASP). In 1948 women were integrated into the independent Air Force. In the mid-1970's there were about 5000 officers and about 27,000 enlisted women.

WOMEN'S CLUBS, GENERAL FEDERATION OF. See GENERAL FEDERATION OF WOMEN'S CLUBS.

WOMEN'S RIGHTS, powers and privileges traditionally enjoyed only by men, which many women in recent times wish to share. Among these rights are control of property, equality of opportunity in education and employment, suffrage, and sexual freedom. The women's rights movement, also known as feminism and women's liberation, arose in Europe in the late 18th century. Although by 1970 most women throughout the world had gained many rights according to law, in fact complete political, economic, and social equality with men remained to be achieved. (See also WOMAN SUFFRAGE; WOMEN, EMPLOYMENT OF.)

Traditional Status. For millennia, women were primarily childbearers and homemakers, whose domestic responsibilities generally prevented their going off to hunt or wage war. Consequently, they did not share in the rights and responsibilities given to hunters and warriors. Even in settled agrarian societies where women worked in the fields, hunting and warfare, with their accompanying rights, remained prestige activities for men.

Supporting this differentiation of role was the belief that women were naturally weaker than and inferior to men. Such a view was sanctioned by religion. For the ancient Greeks, Pandora was the source of evil, and in the Bible, Eve led Adam into sin. God placed Eve under Adam's authority, and Saint Paul urged obedience on Christian wives. In Hinduism the reward of a virtuous woman is rebirth as a man.

Therefore, in most traditional societies, women generally were at a disadvantage. Their education was limited to domestic skills, and they had no access to positions of power. Marriage was almost a necessity as a means of support or protection. Pressure was constant to produce children, who often died young and had to be replaced. A married woman usually took her husband's status and lived with his family, with little recourse in case of ill treatment or nonsupport. Under Roman law, which influenced later European and American law, man and wife were one, with the woman the possession of the man. As such, a wife had no legal control over her person, her own land and money, or her children. According to a double standard of morality, respectable women had to be chaste but men did not, with the result that many women became socially outcast prostitutes. In the Middle Ages feudal law, in which landholding carried military obligation, encouraged the subordination of women to men.

There were some exceptions to women's unquestioning dependence on men. In ancient Babylonia and Egypt women had property rights, and in medieval Europe they could join craft guilds. Some women had religious authority, for example, as Siberian shamans and Roman priestesses. Occasionally, women had political authority, as did Egyptian and Byzantine queens, heads of medieval nunneries, and Iroquois Indian women, who appointed men to clan and tribal councils. A few highly cultivated women flourished in ancient Rome, China, and Renaissance Europe.

Men of the lower classes also lacked rights, but they could console themselves by feeling superior to all women. Struggling to preserve their own dignity in a harsh world, such men were unlikely to sympathize with the plight of women.

Beginnings of Change. The Enlightenment, with its egalitarian political emphasis, and the industrial revolution, which caused economic and social changes, provided a favorable climate for the rise of feminism, along with other reform movements in the late 18th and 19th centuries. In France during the revolution, women's republican clubs pleaded that the goals of liberty, equality, and fraternity should apply to all, regardless of sex. But the subsequent adoption of the Code Napoléon, based on Roman law, obliterated any immediate realization of such hopes on the Continent. In England, Mary Wollstonecraft wrote *A Vindication of the Rights of Woman* (1792), the first major modern feminist work. But its demands for equality and its revo-

WOMEN'S RIGHTS

utionary tone made it unacceptable at that time.

Of deeper significance for women was the industrial revolution. The transformation of handicrafts, which women had always carried on at home without pay, into machine-powered mass production meant that lower-class women became wage earners in factories. This was the beginning of their independence, although in fact factory conditions were hazardous and their pay, lower than men's, was legally controlled by their husbands. At the same time, middle- and upper-class women were expected to stay at home as idle, decorative symbols of virtue and of their husbands' economic success. The only other option for respectable women of any class was work as governesses, clerks, shop assistants, and servants. Such conditions encouraged the feminist movement.

On the Continent, feminist groups appeared sporadically but lacked strength. The Roman Catholic Church opposed feminism on the grounds that it would destroy the patriarchal family. Agrarian countries held to traditional ideas, and in industrial countries feminist demands tended to be absorbed by the socialist movement.

In largely Protestant, rapidly industrializing Great Britain and the United States, feminism was more successful. The leaders were chiefly educated, leisured, reform-minded women of the middle class. In 1848 about three hundred persons held the first women's rights convention, at Seneca Falls, N.Y. Led by abolitionist Lucretia Mott and feminist Elizabeth Cady Stanton, they demanded equal rights, including the vote and an end to the double standard. British feminists first convened in 1855 behind the limited goal of property rights. John Stuart Mill's *Subjection of Women* (1869) focused public attention on their cause.

Colleges were founded for women, such as Mount Holyoke (1837) in the U.S. and Girton (1869) in England, although admission to male-dominated universities took longer. Married women's property acts, passed in England in 1870 and at various times in American States, gave women control over their property. Later, provisions were made for divorce, alimony, and child support. Labor legislation improved hours and wages for women, although women did not generally join unions. Suffrage, which came to be a primary goal of British and American feminists, encountered substantial resistance, despite massive and sometimes violent campaigns. The right to vote was only granted after World War I, partly in recognition of women's war

contributions as paid and volunteer workers.

20th-Century Developments. After wars and revolutions in Russia (1918) and China (1949), new Communist governments discouraged the patriarchal family system and supported sexual equality, including birth control. In the Soviet Union, however, the majority of working women held low-paid jobs and were minimally represented in party and government councils. Birth-control techniques were primitive, day-care centers were few, and working wives were responsible for keeping house and tending children. China more fully preserved its revolutionary ideals, but some job discrimination against women existed. Socialist governments in Sweden in the 1930's established wide-ranging programs of equal rights for women, which included extensive child-care arrangements.

In Britain and the U.S. progress was slower. The number of working women increased substantially after World Wars I and II, but they generally clustered in low-paid, female-dominated occupations, such as school-teaching and clerical work. Few entered the high-paid, male-dominated professions or held major government posts. Advocates of birth control agitated for decades before women's right to family planning was recognized. An Equal Rights Amendment (ERA) to the U.S. Constitution, to remove at one stroke legal, economic, and social restrictions on women, was introduced into Congress in 1923 but made no headway.

In the 1960's, however, changing demographic, economic, and social patterns encouraged a resurgence of feminism. Lower infant mortality rates, soaring adult life expectancy, earlier marriages, and the availability of the birth control pill (after 1960) gave women greater freedom from child-care responsibilities. This fact, combined with inflation—which meant that many families needed two incomes—and a rising divorce rate, propelled more women into the job market. In the late 1960's they made up about 40 percent of the work force in England, France, Germany, and the U.S.

As working women encountered discrimination in many forms, the women's movement in the U.S. gained momentum. On the governmental level, a Presidential commission was established in 1960 to consider equal opportunities for women. Acts of Congress entitled them to equality in education, employment, and legal rights. In 1964 the Civil Rights Act, initially intended only for Blacks, was extended to women. In 1972 the Supreme Court legalized abortion, and the ERA was passed by Congress, although it still required ratification by the States.

On the private level, the women's movement questioned social institutions and moral values, basing many of its arguments on scientific studies suggesting that most supposed differences between men and women result not from biology but from culture. Many women objected that the English language itself, by reflecting traditional male dominance in its word forms, perpetuates the problem. Some experimented with new kinds of male-female relations, including the sharing of domestic roles. In the late 1960's and early 1970's active feminists organized women's-rights groups, ranging from the moderate National Organization for Women (NOW), founded in 1966 and claiming 70,000 members, to smaller, more radical groups. Much attention was given to "consciousness raising" to make women more aware of their common disadvantages. Private and governmental efforts converged in November, 1977, when the largest convention of women ever held in the U.S. met in Houston, Texas, under government sponsorship. It ratified the feminist report drawn up by the Presidential commission, which was intended to serve as an official guide to governmental action.

The objectives of the women's movement included equal pay for equal work; Federal support for day-care centers; recognition of lesbian rights; continued legalization of abortion; and the focus of serious attention on the problems of rape, wife- and child-beating, and discrimination against older and minority women. Although by 1978 the ERA had been ratified by thirty-five of the required thirty-eight States, it was opposed by many women who feared the loss of alimony and of exemption from military service. Moreover, a strong conservative reaction contested Federal support of day care, abortion, and lesbianism on the grounds that they were immoral and destructive of the family.

Elsewhere in the world the women's rights movement has made some progress. In more than 90 percent of the nations women can vote and hold public office. Aided by the United Nations Commission on the Status of Women (1946), women in many nations have gained legal rights and fuller access to education and the professions. The U.N. sponsored the International Women's Year in 1975, marked by a conference in Mexico City representing more than 130 nations.

L.B.A.

WOMEN VOTERS OF THE UNITED STATES, LEAGUE OF. See LEAGUE OF WOMEN VOTERS OF THE UNITED STATES.

WŌNSAN (Jap. *Genzan*), city and port of

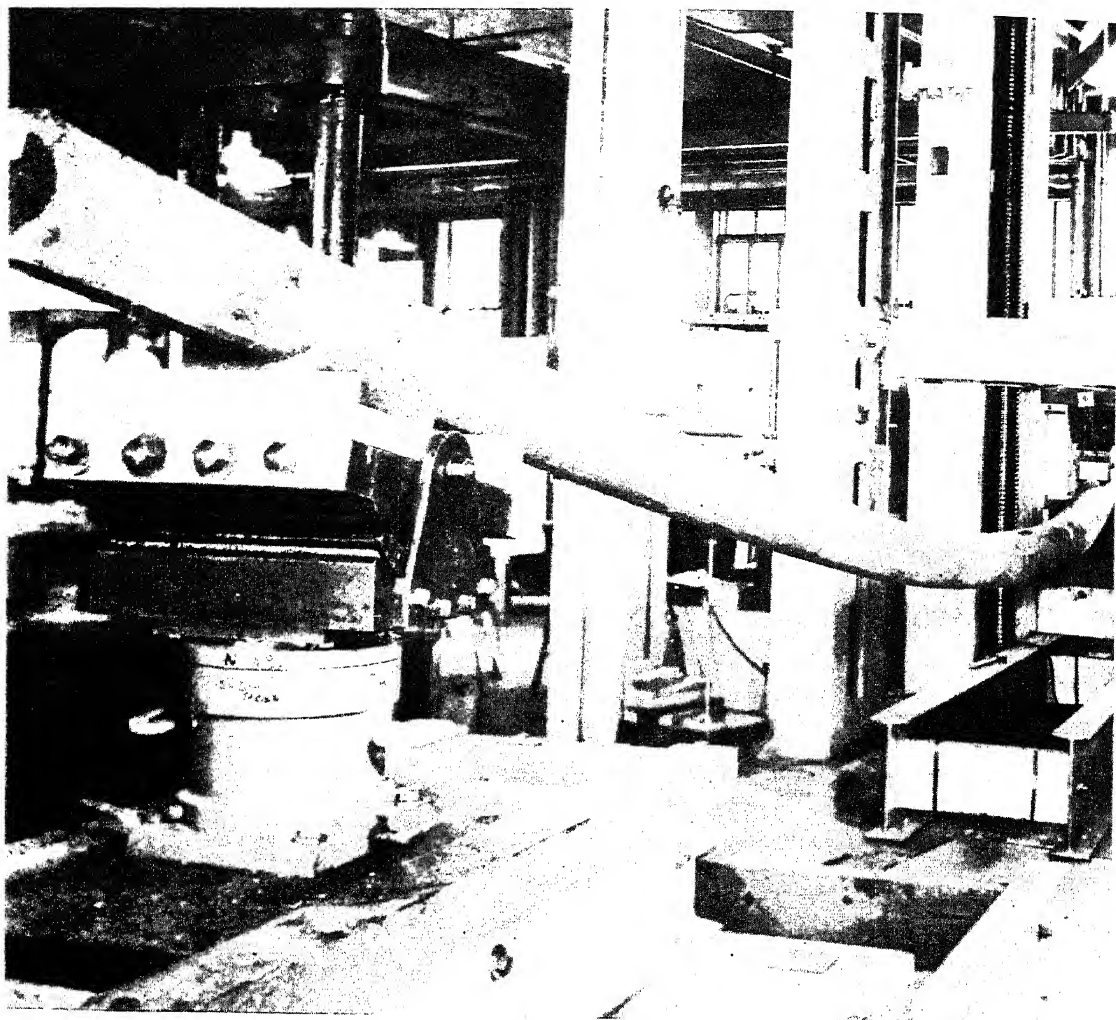
North Korea, on the s.w. inlet of East Korea Bay, about 110 miles N. of Seoul. It has a fine natural harbor and is the commercial center of an agricultural and gold-mining region. Fishing is an important industry, and there are railroad shops, sake breweries, fish-processing plants, and a large oil refinery. Rice, fish, lumber, graphite, and soybeans are exported. Points of interest include an airfield and an experiment station for marine products. Wŏnsan was developed into a modern port by the Japanese; in 1883 it was opened to foreign trade. It served as a Japanese naval base during World War II, and after the war it was included in the Soviet zone of occupation. Wŏnsan sustained very heavy damage during the Korean War (q.v.). Pop. (1970 est.) 275,000.

WOOD, hard, tough substance which forms the trunks of trees, and which has been used for thousands of years as a fuel (q.v.) and as a material of construction; see BUILDING CONSTRUCTION. Technically the term "wood" includes similar materials in other parts of the plant, including even the so-called veins in leaves, but only those portions of wood which have commercial importance are discussed in this article.

For the botanical aspects of wood, including its structure and growth, see TREE; XYLEM. For growth and distribution, see FOREST. For the cultivation of trees for wood, see FORESTRY. For the cutting of trees and the manufacture of lumber, see LUMBER INDUSTRY.

Grain and Structure. The typical markings, called grain, which are found on all types of natural wood, are due to the structure of the wood. Wood consists essentially of fine cellular ducts or tubes, which carry water and dissolved minerals from the roots to the leaves, and which are thus arranged more or less vertically within the trunk. When the wood is cut parallel to the axis of the trunk, straight-grained lumber is usually produced. In some trees, however, the ducts are helical; that is, they twist around the trunk as they ascend. Such trees produce cross-grained lumber, which is also obtained from ordinary trees when the cut is not parallel to the axis of the trunk.

Many woods have prominent annual rings. The trunk of a tree does not grow in length, except at its tip, but does grow in width. The only portion of the trunk which is engaged in active growth is the cambium, a thin layer which entirely surrounds the trunk. In trees of the temperate zones, the cambium lays down new wood during the spring and summer, and in most trees the early wood is more porous and therefore lighter in color than the wood pro-



A full-size wood pole undergoes strength tests to determine its structural properties. U.S. Forest Products Laboratory

duced later in the season. The trunk of a tree is thus surrounded each year by a new pair of concentric sheaths, one darker in color than the other.

Although the thin layer of cambium is the only part of the trunk which is alive in the sense that it is engaged in active growth, living cells are also interspersed among the xylem cells of the sapwood. As the tree grows older, however, the central portion of the trunk dies completely; the ducts become plugged with gums or resins (q.v.), or merely air; see GUM. This central part of the trunk is called heartwood. The internal changes are accompanied by changes in color typical of the species of tree, so that the heartwood is usually darker than the sapwood.

Classification. Woods are classified as softwood or hardwood, depending on the tree from

which they come. Woods from broad-leaved trees are called hardwoods, and woods from coniferous trees are called softwoods, regardless of their actual hardness. Thus many softwoods are actually harder than some of the so-called hardwoods. The hardwoods have long, continuous ducts leading through the trunk; the softwoods do not have such ducts, and the fluids are transported from cell to cell. Many softwoods have resin ducts running parallel to the grain, and softwoods in general contain considerable resin, whereas few hardwoods have any such material in the wood. Most lumber in the United States is softwood; the hardwood is generally used for furniture, high-grade flooring, and other premium uses.

Knots are areas of the trunk in which the base of a branch has become embedded in the body of the wood. When the wood is sawed into planks, the knot becomes evident as a roughly

ircular discontinuity or irregularity in the grain structure. Where the branch begins within the tree, the rings of the knot are continuous with the grain of the wood, producing an intergrown knot; farther out toward the surface, the grain of the trunk has grown around the branch, producing an encased knot.

During seasoning (see below), when the shrinkage in a board varies with the direction of the grain, the knots shrink at a faster rate than the remainder of the wood. An encased knot may thus fall completely out of the plank, forming a knothole. An intergrown knot cannot fall out, but the wood around the knot is distorted by the uneven shrinking, and the board may be weakened even more than by the presence of a knothole. Knots are generally undesirable in lumber from the standpoint of appearance, apart from consideration of their effect on the strength of the wood. In some cases, however, knotty pine and similar types of lumber are desired for paneling interiors, because of the patterns in the grain formed by the knots.

The appearance of wood is one of the most important properties when the wood is being considered for some interior use such as furniture (q.v.) or paneling. Certain woods, such as walnut, have straight, parallel graining, which, when combined with dark, attractive color and great hardness, makes them highly desirable for veneer (q.v.); see also *Plywood*, below. Irregularities of grain, typical of some trees, may make attractive patterns, or lumber may purposely be cut from a crotch to yield wavy, interlocking patterns. Many veneers are made by peeling a thin layer circumferentially from around the trunk, so that the knife cuts across the annual-ring marks only at considerable distances, producing the large, irregular, wavy patterns typical of many plywoods.

Physical Properties. The principal physical properties of wood are strength, hardness (q.v.), stiffness, and density. Density is generally an indication of the mechanical properties, inasmuch as dense woods are usually hard and strong; see **IRONWOOD**. The term "strength" covers a number of essentially different properties, a wood that is high in one kind of strength not necessarily being high in others. Moreover, the strength varies greatly with the state of seasoning, or dryness, of the wood, and with the direction of the grain; wood is always much stronger when cut along the grain rather than across it, and for this reason planks and such articles as poles and handles are always cut with the grain running the long way. Wood has very high compression strength, in some cases higher in proportion to

its weight than steel; it has low tensile strength (q.v.), and moderate shear strength.

High compression strength is required for foundations, and for the main supports of buildings. Bending strength is essential for most structural wooden members, including joists, studding, and beams of all sorts. Many woods which are commonly used for high bending strength have high compression strength, and vice versa, but oak is an example of a wood which is very strong in bending and comparatively weak in compression, whereas redwood is an example of a wood which is strong in compression and comparatively weak in bending.

Toughness is a measure of strength against sudden and repeated stress. Hickory and ash are outstanding for their toughness, and are used in wagon spokes, baseball bats, and ax handles; because hickory is stiffer than ash, it is preferred for thin handles, such as those of golf clubs.

Other less important mechanical properties may be critical for a particular use; for example, the elasticity (q.v.) and resonance of spruce render it the only material suitable for the sounding board of a fine piano (q.v.).

Durability. Wood is naturally a very durable substance. If not attacked by living organisms, it will last for hundreds, or even thousands, of years. Samples of wood used by the ancient Romans have been found virtually in their original condition when a combination of circumstances protected them against attack. The most important of the organisms attacking wood are the fungi (q.v.) which cause so-called dry rot (q.v.), which actually occurs only when the wood is damp. The sapwood of all trees is susceptible to this type of decay, but the heartwood of a few species is naturally resistant to these fungi. Walnut, redwood, cedar, mahogany, and teak are among the well-known woods which are extremely durable. Other woods are resistant to various types of attack. Greenheart and teak are particularly resistant to the attack of marine borers, and so are often used for underwater construction for wharves. A number of woods are comparatively resistant to termites, including redwood, black walnut, mahogany, and several types of cedar; see **TERMITE**. In most of these cases, the woods are aromatic, and the resistance is probably due to the resins and similar chemicals which they contain. The resistance of teak and greenheart to marine borers may be due to the abrasive silica which they contain.

Wood may be preserved by protecting it chemically against deterioration. The most important method of treatment has long been im-

pregnation with creosote (q.v.) or zinc chloride. This method is still one of the best, although a number of newer chemicals, notably several containing copper compounds, have been introduced for the same purpose. Wood can be protected against weathering by suitable surface coatings, applied by brushing, spraying, or dipping. Surface applications yield little penetration, however, and therefore do not prevent deterioration under attack by insects, fungi, or borers.

Seasoning. Freshly cut wood contains considerable water, which amounts to from one third to more than one half of the total weight. The drying of wood before it is fabricated is called seasoning, and is done for a number of reasons. Seasoned wood is far more resistant to decay than fresh wood; it is much lighter and therefore less expensive to ship; it has much higher heating value, which is important if it is to be used as fuel; and, most important, wood changes in shape during drying, and this change in shape should be completed before the wood is fabricated.

Wood may be seasoned either by air-drying or kiln-drying. Air-drying takes several months, whereas kiln-drying takes a few days. In both cases, the wood must be carefully stacked to prevent warping, and the rate of drying must be carefully controlled.

Plywood. Plywood consists of several layers, or plies, of wood thoroughly bonded to one another by glue (q.v.) or synthetic resins. The layers are laid with the grain in different directions, generally perpendicular to one another, so that the resultant sheet of plywood is equally strong in all directions. The bonded joint is at least as strong as the wood itself, and moisture resistant glues can be used if necessary, so that plywood is as durable as the wood of which it is made. So-called laminated wood is a similar product, made by bonding layers of wood with the grain all running in one direction. This procedure results in a product which, like ordinary lumber, is extremely strong in the direction of the grain and weak in other directions.

Only the layers which are on the outside of the plywood need have hardness and good appearance; the inner layers need only be strong. In some cases, only one side of the plywood is a high-grade layer; such plywoods are used, for example, in making a cabinet, the inside of which will not be visible. Fine and expensive woods, such as mahogany, satinwood, ebony, and zebrawood, are now commonly used in the form of plywood, with a thin layer of expensive wood covering several layers of strong but inex-

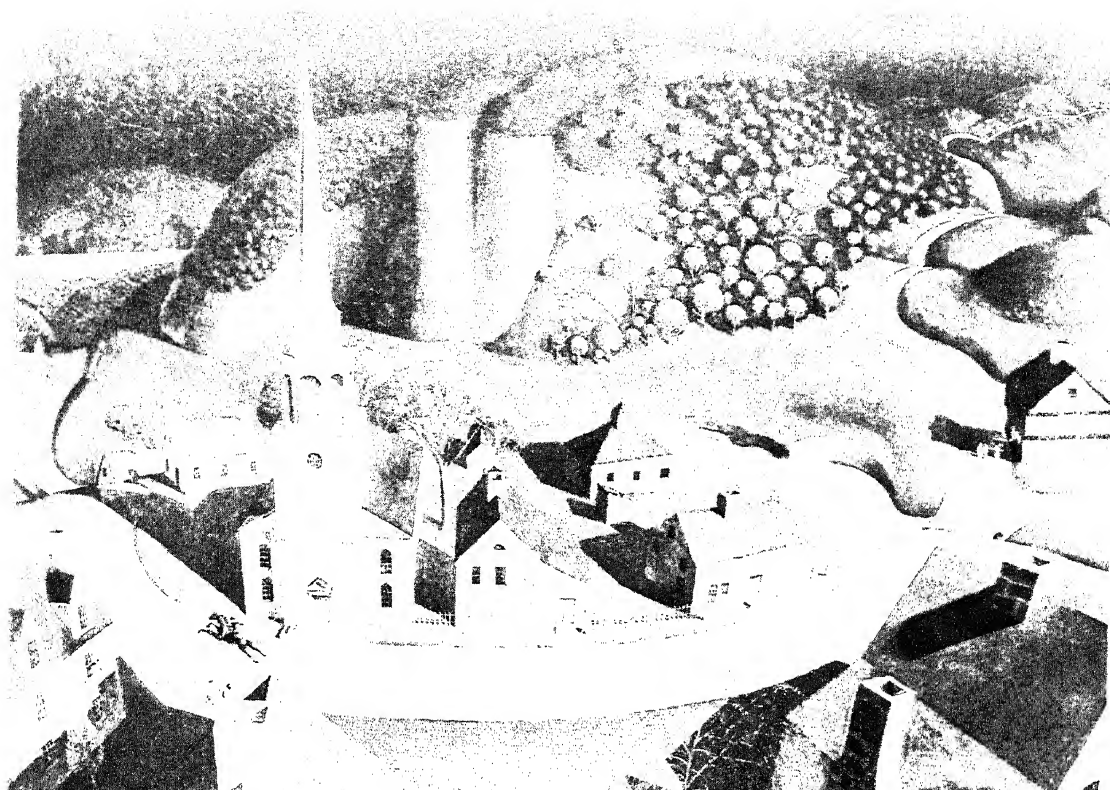
pensive ordinary wood such as Douglas fir. In this way, the expense of the wood is greatly reduced, the appearance is in no way changed, and the strength and resistance to warping is greatly increased. Plywoods made of less expensive wood have been used to substitute for metals, even in airplane construction.

Chemical Wood Products. Wood is an important chemical raw material. An enormous quantity of wood is reduced to pulp and reconstituted mechanically to form paper (q.v.). Some modern industries are based on the extraction from wood of its minor chemical constituents, such as tannins (q.v.), pigments (see PAINTS), gums, resins, and oils, and the further modification of these constituents.

In addition to water, the principal constituent of wood is cellulose (q.v.). Much of the very large quantity of cellulose used today in making rayon and nitrocellulose is obtained from such comparatively pure sources as cotton, but an increasing quantity is being obtained from wood. The chief difficulty in using cellulose from wood lies in separating it from its impurities, the most important of which is lignin, a carbohydrate. Formerly, the lignin was discarded, but it was found to be a raw material for the manufacture of plastics (q.v.) and a suitable medium for the cultivation of yeast, which is an important livestock and poultry feed.

Wood may be used as a chemical raw material, without separating the cellulose from the lignin, by several different processes. In the Bergius process, wood is treated with hydrochloric acid in order to produce sugars, which are either used as cattle feed or fermented to produce alcohol. Wood may be converted into liquid fuels by hydrogenation (q.v.). Wood has long been used also as a source of chemicals by destructive distillation (q.v.). Most of these chemicals, however, including acetic acid, methyl alcohol, and acetone, are now made synthetically.

Certain new products consist essentially of a mixture of wood with certain chemicals; such a mixture will have mechanical properties similar to those of wood, but will be stronger and more resistant chemically. The most important methods of making these mixtures consist of impregnating the wood with certain chemicals, such as a mixture of phenol and formaldehyde, and then heating the impregnated wood so that the chemicals react within the cells of the wood to form a plastic. Wood treated with such resins is known as impreg; it has great resistance to decay and insect and borer attack; its specific gravity is increased, but its strength is increased only slightly, if at all. A different product, called



"Midnight Ride of Paul Revere" (1931) by Grant Wood.
Metropolitan Museum of Art - George A. Hearn Fund

compreg, is made by compressing the impregnated wood in a hydraulic press at pressures of about 1000 lb. per sq.in. while the chemical reaction which forms the plastic is progressing. Such compressed impregnated woods may have specific gravities up to about 1.35. The hardness is many times as great as that of the original wood, and the strength is somewhat greater, although the toughness may actually be less.

In the early 1970's the annual U.S. wood production exceeded 34,000,000,000 bd.ft., of which about 27,300,000,000 bd.ft. were softwoods such as fir, pine, hemlock, and spruce, and about 7,000,000,000 bd.ft. were hardwoods such as oak, maple, poplar, beech, and elm.

See separate articles on most of the woods, or trees, mentioned above. See also BARK; SAP.

AMERICAN FOREST PRODUCTS INDUSTRIES, INC.

WOOD, Grant (1892-1942), American painter, born in Anamosa, Iowa, and trained at the Art Institute of Chicago and at the Académie Julian in Paris, France. He taught art in the public schools of Cedar Rapids, Iowa (1919-24), and served as artist-in-residence (1935-42) at the University of Iowa.

Wood is best known for his later paintings, which depict the scenes and people of his native Iowa. He was strongly influenced by the

subject matter and technique of the early German and Flemish primitive painters. In translating their stylized formality to the American scene, however, he added his own distinctive touches of affectionate irony and hard realism. This satirical treatment can be observed in his most famous work, the double portrait, "American Gothic" (1930, Art Institute of Chicago). Among Wood's other notable paintings are "Daughters of Revolution" (1932, privately owned) and "Woman with Plants" (1929, Cedar Rapids Fine Arts Association, Cedar Rapids, Iowa).

WOOD, Leonard (1860-1927), American physician, soldier, and administrator, born in Winchester, N.H., and educated at Harvard Medical School. In 1885 he entered the United States Army as a surgeon and in 1886 received commendation and a regular commission for his services, both as a surgeon and as a commander of troops, in the campaign against the Apache Indians (q.v.). Upon the outbreak of the Spanish-American War (q.v.) in 1898, he and his close friend the American soldier and later President Theodore Roosevelt (q.v.) recruited a volunteer unit, the so-called Rough Riders, and

that same year Wood commanded the unit in its first battle in Cuba. From 1899 to 1902, following the Spanish surrender, he served as military governor of Cuba. During his administration yellow fever (q.v.) was brought under control and the economic and political situations in Cuba were improved. In 1903 Wood was promoted to the rank of major general in the regular army and assigned to the Philippines, where he served until 1909. Returning to the U.S. that year, he was army chief of staff from 1910 to 1914. Prior to World War I, he was the chief advocate of American preparedness for war. His policies brought him into conflict with President Woodrow Wilson (q.v.), however, and when the U.S. was drawn into the war, Wood was denied an overseas command. In 1920 he was a leading contender for the Republican Presidential nomination but was defeated by Warren Gamaliel Harding (q.v.), who won the national elections. After 1921 Wood was governor-general of the Philippines. His administration was highly unpopular among the Filipinos because he opposed self-rule for the islands; see PHILIPPINES, REPUBLIC OF THE: *History: American Rule*.

WOOD, Robert Williams (1868–1955), American physicist, born in Concord, Mass., and educated at Harvard and Johns Hopkins universities, the University of Chicago, and the University of Berlin (now Humboldt University at Berlin in East Germany). In 1901 Wood was appointed professor of experimental physics at Johns Hopkins University. He remained at Johns Hopkins until 1951, serving as research professor from 1938.

Wood made outstanding contributions in several fields of physics, including optics, theory of light (q.v.), spectroscopy (see SPECTRUM: *Spectroscopes*), and atomic and molecular radiation. He also is known for his work on the diffraction (q.v.) method of color photography, and his research on the physical and biological effects of high-frequency sound waves was of fundamental importance in the development of ultrasonics (q.v.). Wood served as a consultant on the so-called Manhattan Project, the code name of the group of scientists that prepared the atomic bomb during World War II. He received the Henry Draper gold medal from the National Academy of Sciences for his contributions to astronomy (1940). His books include *Physical Optics* (1905), *How to Tell the Birds from the Flowers* (1907; rev. ed., 1917), a collection of humorous poems, and *The Man Who Rocked the Earth* (1915).

WOOD ALCOHOL or **METHANOL**. See ALCOHOL: *Wood Alcohol*.

WOODBINE. See HONEYSUCKLE.

WOODBIDGE, township of New Jersey, in Middlesex Co., just N. of Perth Amboy, and 12 miles s.w. of Newark. The rich clay deposits in the vicinity provide the basis for an important brick, tile, and pottery industry. There are also boat yards and factories producing chemicals, radio tubes, beverages, and processed dairy products. Colonists from Massachusetts and New Hampshire settled Woodbridge in 1665; it was incorporated in 1669. The first printing press in New Jersey was established there in 1751. Pop. (1960) 78,846; (1970) 98,944.

WOOD BUFFALO NATIONAL PARK. See ALBERTA: *The Land: Parks and Other Places of Interest*.

WOODBURY, city in New Jersey, and county seat of Gloucester Co., on Woodbury Creek about 13 miles s.w. of Camden. Primarily residential, the city is a trading center for the surrounding fertile truck-gardening and fruit-growing area. In the city are many 18th-century buildings. Woodbury was settled in 1683, incorporated as a borough in 1854, and as a city in 1870. Pop. (1960) 12,453; (1970) 12,408.

WOOD CARVING, art of shaping statues, ornaments, furniture, and utensils out of wood by means of cutting tools, drills, and abrasives. Wood as a medium is light, supple, and workable; it has tensile strength, and separate pieces may be easily joined. It has the natural beauties of grain and variety of texture, though it lacks the weight, durability, and monumental quality of stone. Our knowledge of the history of wood sculpture is distorted by the haphazard survival of carvings, which are vulnerable to dampness, fire, and the destructive activity of worms and insects. Wood to be carved is usually cut and rough-hewn with axes, saws, and knives. Various gouges, chisels, drills, and knives are then used for the actual carving. Pieces are finished with rasps, files, and sandpaper. Carvings may be painted or gilded directly on the surface or over a layer of cloth or plaster, or the wood may be left in its natural state and polished.

Distribution. The art of wood carving has been a basic mode of expression in primitive cultures, taking different forms according to the sharpness of the tools employed and the hardness and other characteristics of the available wood. It is prevalent in nautical societies, where wood has been used to make and decorate boats, often with images to strike terror into enemies. Examples range from the prows of Viking ships to the figureheads of 19th-century European vessels.

Wood carving was virtually unknown in the

Babylonian, Assyrian, and ancient Persian cultures. It was common, however, in Egypt: Both the royal images and the ceremonial furniture in the tomb of Tutankhamen (14th cent. B.C.) were fashioned of wood. The ancient Greeks used wood in their archaic sculpture, but they came to prefer the more durable media of bronze and stone, as did the Romans.

In northern Europe wood has been an important sculptural medium, especially in Germany, the Netherlands, and Scandinavia. It played a significant role in England and France and formed the backbone of Spanish sculpture from the Romanesque to the baroque periods. Even where carved wood has not played a vital part in figurative sculpture, it has been used almost universally to construct furniture down to the present day.

In the Far East, wood carving has been a vigorous branch of sculpture, particularly in the art of India, China, and Japan, as seen in carved wooden Buddhas. Richly ornamental carving survives in parts of Indonesia. In the Islamic cultures, where depiction of the human image is considered impious, wood has been used in elaborate decorative carvings. The indigenous cultures of the Pacific—Maori, Melanesian, and New Guinean—are noted for their carved woodwork, especially in canoes, domestic architecture, and ceremonial furniture. The North American Indians used wood not only for weapons, utensils, and masks; the totem poles of the northwestern coast serve as family and clan emblems and sometimes record hierarchies of gods and animals. African sculpture, which consists chiefly of wood carvings, is remarkable for its ceremonial masks and idols.

Early Uses in Europe. After the hiatus in the use of wood for sculpture throughout the Greco-Roman world, the carved cypress doors of the Church of Santa Abina in Rome (5th cent. A.D.) mark the beginnings of a new tradition of Christian narrative sculpture. In northern Europe, this was easily assimilated by the Vikings, who had long carved interlaced patterns and imaginary beasts into their ships and buildings. By about the year 1000, solemn images of the seated Virgin and Child and of Christ on the Cross (usually flanked by standing figures of Mary and Saint John mourning) abounded in churches. Wood, because of its lightness compared to stone, was favored for the Crucifixion groups that were set on a beam or screen across the entrance to the chancel. The style of these figures, elongated and confined within roughly cylindrical shapes, was partly dictated by the natural shape of the trunk or branch of a tree.

Gothic Wood Carving. From the Gothic period, many of the increasingly elaborate furnishings of churches were carved out of wood: choir stalls and canopies, screens, pulpits, and lecterns. Tip-up seats known as misericords, popular in English cathedrals, contain a fascinating repertory of medieval symbolism, both sacred and profane. In Flanders, Germany, and Spain, the tradition of retables—narrative panels of carving or painting (usually devoted to the life of Christ or a saint) set in elaborately carved frames—for altarpieces was established in the 15th century and survived well into the baroque period. These were usually equipped with painted and carved wooden wings that could be closed in front like the doors of a cupboard, both for protection and for concealment. Antwerp, Brussels, and Malines were famous centers of production that exported retables all over Europe. In the Middle Ages, carved wood frequently formed the core of items such as reliquary busts of saints, which were coated with sheets of precious metal and studded with gems. By the 16th century, the increasing size and importance of church organs made them a focus of carved decoration, while in secular life, coaches for royalty and other dignitaries began to be gorgeously carved.

In the 15th century, wood carving, like other art forms, ceased to be anonymous, and individual artists are identified by name. The German sculptor Bernt Notke (about 1440–1509) created a "Saint George" (Stockholm Cathedral) that is unforgettable; Veit Stoss (q.v.) and Tilman Riemenschneider (1460?–1531), also Germans, were unequalled in their mastery. Indeed, the solemn, ovoid faces of Riemenschneider's female figures characterize southern German sculpture about 1500. In the Rhineland and Swabia the physical properties of linden wood determined an art style of complex undercut drapery folds swinging free from the figure. This construction minimized the risk of splitting as the wood swelled and contracted with changes in humidity. There was also a fashion in Germany and the Netherlands for small statues carved out of close-grained woods, such as box and pear. These date from the late 15th century to the baroque period; Veit Stoss and his followers contributed numerous miniature masterpieces.

The Renaissance in Italy and Spain. In Italy, although the example of ancient Greece and Rome discouraged the use of wood during the Renaissance, there are a few outstanding carved statues, three by Donatello (q.v.): his early "Crucifix" (about 1409; Florence); his "Saint John" (1438; Venice); and his most dramatic statue, the "Saint



Saints Peter and Andrew, detail from the Marienaltar (1502-05) in the Herrgottskirche, Creglingen, Germany. This great linden wood altarpiece is by Tilman Riemen-schneider.
German Information Center

Mary Magdalene" (about 1455; Florence). Standing figures of the "Virgin Annunciate" and the "Angel Gabriel" carved by Donatello's contemporary in Siena, Jacopo della Quercia (q.v.), set a fashion that was much imitated. The Italians also carved choir stalls and sacristy cupboards, frequently inserting flat decorations in wood marquetry (q.v.). Secular carvings included beamed and coffered ceilings, as in the Room of the Lilies in the Palazzo Vecchio in Florence. Michelangelo's Laurentian Library (about 1530) in Florence had ceilings and reading desks that were carved to his designs. Linen chests and picture frames were also elaborately carved with ornamental designs and figures. In Venice, the decoration of the doge's barge and other craft led to a vigorous school of wood carving, which also produced works for church interiors.

In Spain the art was carried to extremes in vast retables that often reached the full height of a church interior. Structures of their complexity provided employment for many wood carvers; wood thus became a standard medium of Spanish sculptors for several centuries. It was used to especially good effect by Alonso Berruguete (q.v.), a mannerist follower of Michelangelo, in

his retable of San Benito (Valladolid Museum). The ease of carving and the lightness of wood permitted grandiose constructions in Spain that had no parallel in Italy. Sculptors such as Gregorio Hernández (1576-1636), Juan Montañés (1568-1649), and Alonso Cano (1601-67) produced most of their work in wood, with painted surfaces to make the figures appear lifelike.

18th Century to the Present. In England one name stands out: Grinling Gibbons (1648-1721), celebrated for his technical dexterity in undercutting the leaves and flowers of his superb, decorative festoons. In Flanders there was a late baroque outburst of oak carving in extraordinary pulpits with landscape settings and life-size figures forming dramatic tableaux. Wood was esteemed by baroque and rococo sculptors in southern Germany and Austria because its strength and lightness, together with paint and gilt, enabled artists to create the illusion of figures flying in the clouds; Ignaz Günther (1725-75) was the supreme craftsman.

During the 19th century, wood was used mainly for church and domestic furniture and in

"Woman at the Piano" (about 1917), by the American sculptor Elie Nadelman, was inspired by folk art.
The Museum of Modern Art, New York City—
The Philip L. Goodwin Collection

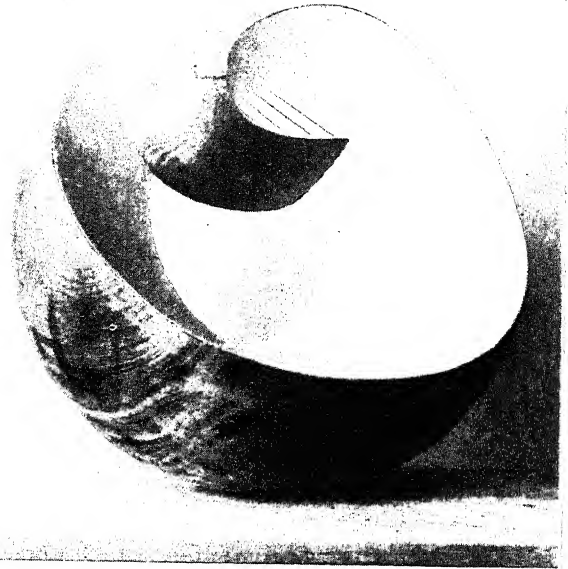


architectural details. Designs were created in a pastiche of earlier art styles. In the 20th century, the discovery by artists of "primitive" wood carvings as executed in nearly contemporary ethnic cultures led to a sudden appreciation of the expressive potential of the material. Paul Gauguin imitated the style he found in the South Seas, while Henri Matisse, Amedeo Modigliani, and Pablo Picasso (qq.v.) all occasionally resorted to wood. The Rumanian sculptor Constantin Brancuși (q.v.) created abstract works that exploited the qualities of the material. Perhaps the most remarkable extension of range was in England, where Henry Moore and Barbara Hepworth (qq.v.) have studied the natural conformation and grain of wood for inspiration in shaping their carvings.

In the United States, where wood had played a prominent part in the 18th and 19th centuries in various forms of folk art, its use as a sculptural medium dwindled in the 20th century. Although finely carved works were executed by such representational sculptors as Robert Laurent (1890-1970), Elie Nadelman (1882-1946), Chaim

"Monk Reading" (1930), wood sculpture by the German Ernst Barlach, who worked in a simplified modern style.

German Information Center



"Pelagos" (1946), by the British sculptor Barbara Hepworth, exploits the grain of the wood. The Tate Gallery

Gross, and William Zorach (qq.v.), by the 1940's the trend toward abstract design had ushered in an era dominated by metal. C.A.

WOODCHUCK. See MARMOT.

WOODCOCK, common name applied to game birds of the American species *Philohela minor* and of the European species *Scolopax rusticola* belonging to the Sandpiper family, Scolopacidae. The American woodcock has short, stout legs and averages about 11 in. in length. The head is relatively large with a long, straight bill, the upper section of which can be flexed like a finger. The eyes are prominent and dark and are set far back on the head. The woodcock is predominantly brown, mottled with black, gray, and russet.

Native to eastern North America, the woodcock lives in wooded bottomlands, where the soft, moist earth yields its favorite food, the earthworm (q.v.). The bird remains hidden by day, protected by its coloration, which blends into the woody surroundings.

During the mating season, the male chooses a protected nesting site, usually one bordering a meadow or other cleared area, where he performs a spectacular courtship ritual. The latter takes place in the twilight hours after sunset or before dawn. At the start of his effort to attract a mate, the woodcock struts about with drooping wings and raised tail and utters low, whining sounds punctuated by a single, nasal note. Suddenly darting off, he spirals upward from 100 to

300 ft. with much twittering, and then dives downward at great speed. A characteristic whistling note heard during the descent is believed to be caused by the rush of air through the stiff feathers. The nest of the woodcock is made of dried leaves and grass, and is built in a depression on the ground, often near water. The female lays four spotted eggs in a clutch; the incubation period is twenty-one days.

The annual migration to the south occurs soon after the first frost. Most woodcocks spend the winter in Louisiana or other Gulf States, but some hardy individuals remain as far north as New Jersey.

WOODCOCK, Leonard Freel (1911-), American labor leader.

Born Feb. 5, 1911, in Providence, R.I., Woodcock attended college in Detroit, Mich., but left school to work in a factory. In the late 1930's he became active in union affairs, eventually serving (1940-44) on the staff of a United Auto Workers (U.A.W.) regional office. In 1946 he was named first administrative assistant to Walter Reuther, who was president of the U.A.W. In subsequent years Woodcock held other important union positions. In 1955 he was elected a vice-president, with responsibility for negotiations with General Motors and with the aerospace industry—bargaining that achieved unprecedented results under his leadership. After the death of Reuther in 1970, Woodcock was chosen to be his successor by the union's executive board; he was reelected by the union membership in 1972.

WOOD DUCK, American freshwater duck, *Aix sponsa*, of the subfamily Anatinae. The male is an exceedingly handsome bird with beautifully colored plumage. The back is lustrous violet and green, the head iridescent green and purple, the breast purplish chestnut spotted with white, the sides yellow with black bars, and the belly white. The female wood duck is duller in coloring, mostly brown above and white below, with characteristic white rings circling her eyes. Both the male and female are rather large (20 in. long) and have crested heads. They frequent ponds and streams in the woodlands and nest in the hollows of trees, sometimes as high as 40 ft. from the ground. A clutch has eight to fourteen eggs.

As a result of excessive hunting the population of this species was reduced considerably in the early 1900's, but legislative protection has restored it to some extent. Breeding can be encouraged by the construction of nesting boxes. The wood duck breeds from southern Canada throughout the United States. It winters from

southern Virginia and southern British Columbia south to Jamaica and central Mexico.

WOOD ENGRAVING or **WOODCUTTING**, art or process of cutting designs into wood and printing the designs on paper. The piece of wood on which the design is cut is called a wood block, and a print made from a wood block is known as a woodcut or wood engraving. In wood engraving the parts of the wood block carrying the design are raised in relief (q.v.), rather than depressed, to take the ink. This process is the reverse of that used in metal engraving (q.v.); see **INTAGLIO**. The woodcut can achieve the effects of pen-and-ink drawings, charcoal sketches, brushwork, and line engravings on copper. It can be used for the finest reproductions and for highly original works of art as well as for simple handbills.

Methods of Wood Engraving. The four common types of woodcuts are black-line, white-line, chiaroscuro (q.v.), and color-print.

Black-line cuts, the oldest type, are made from blocks of wood, such as apple, cherry, beech, or sycamore, that have been sawed parallel to the grain. One side of the block is planed and sanded and the design is then drawn on the smooth surface. The wood around the design is cut away with a sharp knife or carver, after which the finished block is inked and pressed on paper either by hand or by machine. In the resulting print the design will appear dark against a background of white.

The white-line woodcut is made from blocks of very fine hardwood, usually boxwood, that have been sawed against the grain. A wider variety of cutting instruments is used than with black-line cuts, for example, gougers, burins, chisels, scoopers, and parting tools, which thus enable the engraver to cut finer lines and achieve a more subtle gradation of tone.

In chiaroscuro wood engraving, two blocks, and occasionally, more, are used to make a print. The first is an ordinary black-line block. The print taken from this block is subsequently impressed with a second block that prints only ground colors, such as sepia or dark gray. For highlight effects, spots may be gouged out of this second block. The final print gives the impression of darkened or obscured light.

The color-print cut can be made either from one block or from a series of blocks. In the single-block method, the design is painted on the block in color and the block then pressed on paper to yield a colored print; the colors are kept separate by guide lines cut into the block. When a series of blocks is used, each block receives one color in the desired areas, at most

Japanese woodcut of
young women sitting by
a heated foot warmer
and a cat's cradle.
Metropolitan Museum of Art



two or three colors in substantially separated areas. By successive applications of the blocks a print is produced in all the desired colors. The second method yields better results than the first, because the colors are kept apart more successfully.

Early History. Woodcuts are the oldest form of prints. Blocks of wood cut in relief were used by the ancient Egyptians and Babylonians to impress designs on brick, and the ancient Hindus used engraved wood blocks to print their textiles (q.v.). In medieval Europe, the outlines of ornamental initial letters in certain manuscripts were stamped from wood blocks.

Woodcutting in the modern sense was born only after the development of paper (q.v.), for it was not practicable to print on vellum, papyrus (q.v.), or the other materials employed previ-

ously; see PARCHMENT AND VELLUM. The Chinese, the first to manufacture paper, produced the first woodcuts during the T'ang Dynasty (618–907). The Japanese, who learned woodcutting from the Chinese in the 8th century, carried the art to its highest development. Their color prints are acknowledged to be unsurpassed in the history of woodcuts. See JAPANESE ART AND ARCHITECTURE.

The oldest European woodcut that can be dated definitely is "St. Christopher", printed in 1423, and now in the John Rylands Library, Manchester, England. In southern Germany and the Netherlands, the first real centers of woodcutting, early prints were merely rough outlines to which tints were added by hand. The designs were naive and crude, mainly of religious subjects, and were produced anonymously for pop-



"Virgin Seated by a Tree"
(1513), wood engraving
by Albrecht Dürer.
Parke-Bernet Galleries

ular edification and entertainment. Although some of the early artists in woodcuts engraved and printed their own designs, wood engraving and the actual printing soon became separate crafts. Artists more and more had their designs both cut and printed by specialists.

By the middle of the 15th century sequences of woodcuts, each containing several pictures and accompanied by short texts, were being bound together into books. Among the earliest of such block books are the *Apocalypse* and the *Ars Moriendi* ("The Art of Dying"), both dating from the period 1430 to 1450. Somewhat later

are the *Biblia Pauperus* ("Poor Man's Bible") and the *Canticum Canticorum* ("Song of Songs"). Most of these block books were produced in Germany, but those published in the Netherlands were generally of superior quality.

With the invention of printing from movable type (qq.v.), the progenitors of the modern illustrated book were produced; see PRINTING TECHNIQUES. Printed books illustrated with woodcuts soon became very popular. Among the earliest German illustrated books were the *Psalter* of Johann Fust (1400?-66?) and Peter Schoffer, printed in Mayence (Mainz) in 1457, and the

Liber Similitudinis ("Book of Similitudes"), a collection of fables published in Bamberg in 1461. The famous Cologne Bible, printed between 1470 and 1475, has 109 woodcut illustrations.

The art of woodcutting and of illustrating printed books soon spread from Germany and the Netherlands throughout western Europe. Lyon, France, became an important center about 1476, and Paris somewhat later. The various *Livres des Heures* ("Books of Hours") printed in Paris in the late 15th century contain some of the finest examples of early woodcutting art. Venice was also a major center, distinguished particularly for the elaborately decorative designs of its woodcuts.

The Peak Period. In the 16th century the art reached its peak, especially in the work of the great German artists Albrecht Dürer and Hans Holbein, the Younger (q.v.). Advancing beyond the outline cut, Dürer introduced areas of light and shade, thus achieving some of the effect of color and eliminating the need for tinting. His "Apocalypse", "Great Passion", and "Life of the Virgin" series, which rank high among his works in all media, are among the very finest woodcuts ever produced. Holbein's woodcut series "The Dance of Death", executed by the master craftsman Hans Lützelberger, contains equally great work. Other German masters include Lucas Cranach (q.v.), Hans Baldung (1476?–1545) and Just de Negker, who probably invented chiaroscuro. Lucas van Leyden (q.v.) was the greatest Dutch master of the 16th century. In Italy, the best work of that period was done by Marcantonio Raimondi (1475?–1534?), Ugo da Carpi (about 1455–about 1523), and Andrea Andreani (1540?–1623); in France, by Jean Cousins (1490?–1560) and Bernard Salomon.

Recent Times. Etching (q.v.), developed in the 17th century, led to the decline of the woodcut. In the 18th century the British wood engraver Thomas Bewick (1753–1828) laid the basis for the modern revival of the art by developing the white-line woodcut. A comparable influence was exercised by the British poet and artist William Blake (q.v.), who, by printing his own woodcuts, established the practice followed by the best contemporary artists.

In the 19th century the most notable woodcuts were created in France and the United States. The woodcut book illustrations of the French artist Gustave Doré (q.v.), including those for the Bible, are among the most famous ever done. Later in the century the French post-impressionist painter Paul Gauguin (q.v.) de-

signed woodcuts of great decorative beauty, and his fame as an artist helped stimulate interest in the medium. The American engraver Alexander Anderson was a leading figure in the American school of woodcutting. Timothy Cole (q.v.) is the outstanding American master of the



In a simple wood engraving the inked design, carved into a smoothed block, becomes the printing surface.

late 19th and early 20th century. The art of woodcutting achieved full maturity at the hands of such contemporary American artists as Rockwell Kent (q.v.), Allen Lewis (d. 1957), and Lynd Ward. Also noteworthy is the work of the British woodcutters Clare Leighton and Eric Gill (q.v.) and of the German artist Ernst Heinrich Barlach (q.v.). Woodcutting has recently become a leading art medium in Latin America, particularly in Peru, Ecuador, and Mexico.

WOOD IBIS. See STORK.

WOODLAND, city in California, and county seat of Yolo Co., about 17 miles N.W. of Sacramento. A processing and marketing area for rice, sugar beets, walnuts, and almonds, Woodland was known as Yolo City until 1859. The city was founded in 1853 and incorporated in 1874. Pop. (1960) 13,524; (1970) 20,677.

WOOD LOUSE

WOOD LOUSE, common name applied to numerous species of various terrestrial crustaceans of the order Isopoda (q.v.), and native to most regions of the world. Found frequently in gardens, they live under rocks or in other damp places and feed on decaying animal or vegetable matter. The wood louse has a flattened body with seven pairs of legs, and the respiratory organs are completely infolded by perforated plates. Some varieties, known as pill bugs, are capable of rolling themselves up into a ball when disturbed. The species vary in color from gray to black. See CRUSTACEA.

WOOD OIL TREE. See TUNG.

WOODPECKER, common name for any of more than 200 species of birds belonging to the family Picidae, and known for their ability to cling to the trunks of trees and dig holes in the wood with their beaks. The woodpecker has a sharp, straight, chisel-shaped bill and a long, extensible tongue with a hard, spear-shaped tip. The toes are usually in pairs, two before and two behind, and have sharp, strong claws. The tail is usually rigid and lengthened; the shafts of the feathers terminate in hard spines, which the birds press against a vertical surface to help support their body weight. The keel of the breastbone is small, thereby lessening the powers of flight.

Woodpeckers are found throughout most of the world, are usually solitary in habit, and nest chiefly in forest areas. The birds subsist mainly on insects that they detect by tapping the wood of trees with their bills. They excavate the insects by pickaxlike strokes of the bill. Woodpeckers generally nest in holes cut into the trunks of trees, the female depositing several shiny, white eggs in a soft bed of rotted chips at the bottom of the cavity.

The American species include the pileated woodpecker, *Dryocopus pileatus*, which is nearly 18 in. long and mostly black in color, with a red crest and white stripes along its neck and sides. Another similar species, the ivory-billed woodpecker, *Campephilus principalis*, is nearly extinct. The most common species in the United States, found in orchards, is the downy woodpecker, *Dendrocopus pubescens*, a small black and white species. A larger counterpart, the hairy woodpecker, *D. villosus*, is also common. The 10-in. red-headed woodpecker, *Melanerpes erythrocephalus*, is common west of the Allegheny Mts. A species found in California, *M. formicivorus*, called the acorn woodpecker, is remarkable for its habit of storing acorns. The yellow-shafted flicker, *Colaptes auratus*, of the East and parts of northwestern Can-

ada and Alaska, and the red-shafted flicker, *C. cafer*, of the West, are species that hunt ants on the ground. See also SAPSUCKER.

WOOD RIVER, city of Illinois, in Madison Co., on the Mississippi R., about 65 miles s.w. of Springfield. Oil-refining is the major industry. Wood River was founded in 1907 and incorporated as a city in 1923. Pop. (1960) 11,694, (1970) 13,186.

WOODS HOLE MARINE BIOLOGICAL LABORATORY. See MARINE BIOLOGICAL LABORATORY.
WOODS HOLE OCEANOGRAPHIC INSTITUTION, Woods Hole, Mass., an independent nonprofit organization for the study of the ocean in all its aspects, with particular emphasis on the Atlantic Ocean and adjacent seas. The institution, founded in 1930 with an endowment from the Rockefeller Foundation, derives most of its income from grants and contracts from agencies of the U.S. government. The institution, which has a staff of about 125 scientists and 400 assistants, operates four oceangoing research vessels, a submarine, an airplane, and a helicopter. Since 1967, the institution and the Massachusetts Institute of Technology (q.v.) have offered joint graduate programs to qualified graduate students in ocean engineering and oceanography.

WOODSON, Carter Godwin (1875–1950), American historian, born in Buckingham County, Va. He entered high school at the age of twenty and taught elementary school for two years after his graduation. Woodson later studied at Berea College, the University of Chicago, and Harvard University, receiving a Ph.D. degree from Harvard in 1912. He was dean of the school of liberal arts at Howard University in 1919–20 and of West Virginia Institute (now West Virginia State College) from 1920 to 1922.

Woodson devoted his life to making "the world see the Negro as a participant rather than as a lay figure in history". To this end he established (1915) the Association for the Study of Negro Life and History; founded (1916) and edited (1916–50) the *Journal of Negro History*, a quarterly; organized (1926) the first annual Negro History Week; and founded (1937) the *Negro History Bulletin*, a monthly. Among his many books are *Education of the Negro Prior to 1861* (1915), *History of the Negro Church* (1921), and *The Rural Negro* (1930).

WOODSTOCK, Great Britain, municipal borough of Oxfordshire, England, 8 miles n.w. of Oxford. It was the scene of a council held by King Henry II (q.v.) in 1163, and was the site of the house built by him for his mistress Rosamond Clifford (d. 1176?), known as Fair Rosa-

Yellow warbler, *Dendroica*
 coronata Hal H. Harrison -
 National Audubon Society



mond. Edward (q.v.), Prince of Wales, known as the Black Prince, was born here in 1330, and here Elizabeth I (q.v.) was imprisoned (1554) for six months during the reign of her sister Queen Mary I (q.v.). The manor of Woodstock, a favorite royal residence, was bestowed in perpetuity on John Churchill, 1st Duke of Marlborough (q.v.), after his decisive victory in the Battle of Blenheim (q.v.); Blenheim Palace, built for him by the nation, is nearby. Pop. (1971) 1940.

WOOD THRUSH. See THRUSH.

WOODVILLE, city of Australia, in South Australia, 4 miles N.W. of Adelaide. It borders on the Torrens and Port rivers and Gulf Saint Vincent and lies on the railroad connecting Adelaide and Port Adelaide. Chiefly residential, it is also the site of the Cheltenham Racecourse and of an automobile assembly plant. Pop. (1971 prelim.) 72,703.

WOOD WARBLER. 1. Any of some 119 species of small birds of the New World family Parulidae, including fifty-four species native to North America. All are from 4½ to 7 in. in length. Many are brightly colored in spring plumage, especially the males. In general, they are insectivorous, live in woods, thickets, or swamps, breed in North America, lay four or five eggs, and mostly winter in the tropics. Their songs are, as a rule, pleasing but weak. They are popular with bird watchers, particularly in spring when flights of the birds mark the height of the spring migration. Well-known species include the following.

The common black-and-white warbler, *Mniotilta varia*, is an early migrant that creeps about the trunks and branches of trees. It has a thin, sawlike sound heard in the spring when the

woods are still bare. It breeds from northern Georgia to northern Canada and west to the Great Plains. The common, yellow warbler, *Dendroica petechia*, is found from coast to coast. It is fond of gardens and of bushes along streams and marshes. The deep nest of the yellow warbler is often lined with plant down. The bird breeds from South Carolina and central Texas north to the tree line.

Three of the most beautiful eastern warblers are the black, yellow, and white magnolia warbler, *D. magnolia*; the brilliant, flame-breasted Blackburnian warbler, *D. fusca*; and the slate-backed, yellow-breasted Canada warbler, *Wilsonia canadensis*, which has a handsome necklace of black spots. Other eastern warblers include the uncommon Cape May warbler, *D. tigrina*, which has chestnut cheek patches and a very high, thin song; and the black-throated blue warbler, *D. caerulescens*, which has a distinctive small white square on its wing.

The common, yellow-rumped myrtle warbler, *D. coronata*, likes bayberries and winters north to Kansas and southern New England. Audubon's warbler, *D. auduboni*, the Western counterpart of the myrtle, has a yellow throat. Other well-known Western species include the black-throated gray warbler, *D. nigrescens*, found on dry-chaparral slopes; Townsend's warbler, *D. townsendi*, which has a conspicuous black ear patch; Grace's warbler, *D. graciae*, found in the ponderosa pines of the Southwest; and the yellow-headed hermit warbler, *D. occidentalis*, found in the tops of tall conifers in the Northwest.

Dwellers in dry areas include the aptly named

WOODWARD

pine warbler, *D. pinus*, which lives amid pines; the inaptly named prairie warbler, *D. discolor*, which lives in low, dry, second-growth thickets, not on prairies; and the beautiful hooded warbler, *W. citrina*, which breeds on dry hillsides north to Connecticut.

Other members of the wood warbler family include the chat, yellowthroat, redstart (qq.v.), ovenbird, and water thrush; see THRUSH.

2. The wood warbler, *Phylloscopus sibilatrix*, a small (5 in. long), greenish bird of the Old World warbler family, Sylviidae. It lives in Europe but winters in Africa. See WARBLER.

WOODWARD, Robert Burns (1917-79), American chemist, born in Boston, Mass., and educated at the Massachusetts Institute of Technology. From 1941 to 1963 he taught chemistry at Harvard University. In 1963 he became director of the Woodward Research Institute in Basel, Switzerland. With the American chemist William von Eggers Doering (1917-) he synthesized quinine in 1944. Woodward synthesized cholesterol and cortisone (qq.v.) in 1951, and subsequently supervised the research which led to the synthesis of strychnine in 1954. He was head of a research team that synthe-

sized the tranquilizing drug reserpine (q.v.) in 1956. For his work in chemical synthesis, he was awarded the 1965 Nobel Prize in chemistry. He is known also for his research on antibiotics.

WOOD WASP. See HORNTAIL.

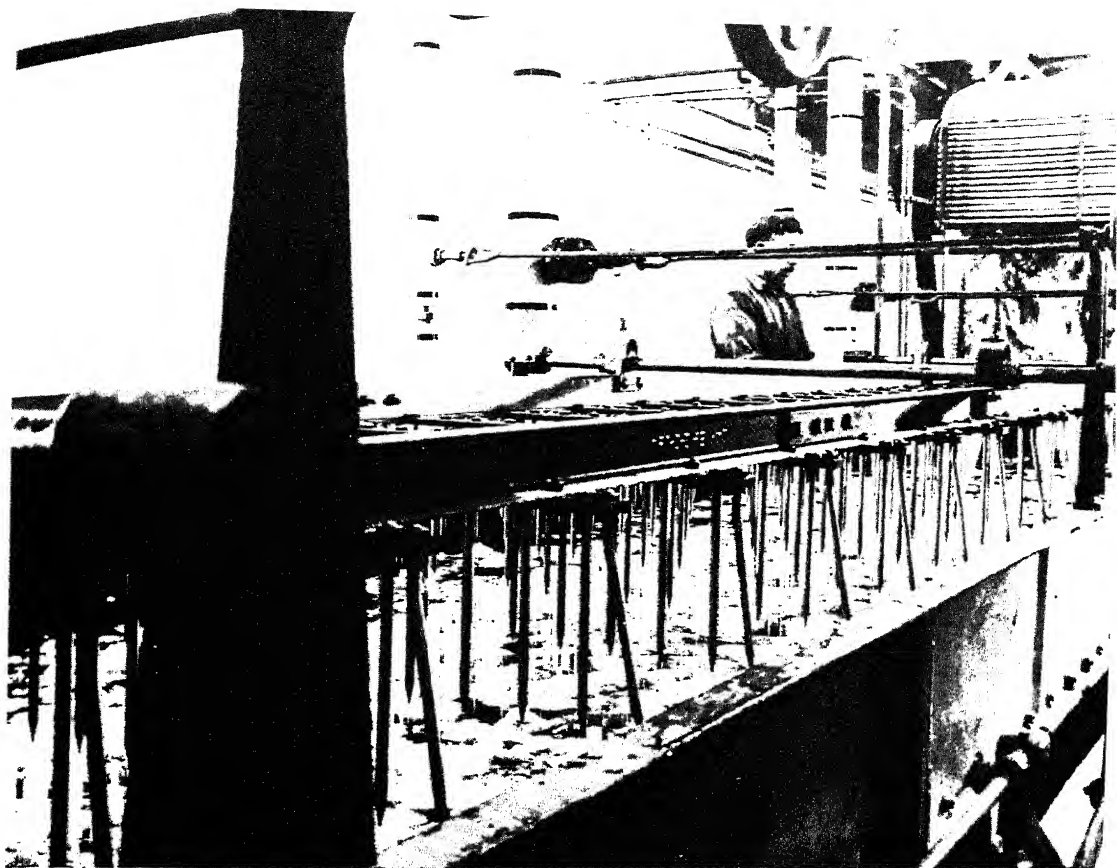
WOODWIND INSTRUMENTS. See MUSICAL INSTRUMENTS: *Wind Instruments*.

WOOL, common name applied to the soft, curly fibers obtained chiefly from the fleece of domesticated sheep (q.v.), and used extensively in textile manufacturing. Wool may be differentiated from hair (q.v.) mainly by the nature of the scales that cover the outer surface of each fiber. Wool scales are numerous, minute, and pointed, and are attached only at their bases, thus the fibers interlock under pressure; see FELT. The number of scales varies with the fineness and curliness of the fiber. Because of its crimp, or curl, wool has considerable resilience. This quality, together with its high tensile strength and elasticity, gives fine woollen fabrics the ability to retain shape better than cloth made from other natural fibers. Other characteristics of wool, which make it especially desirable for clothing, are its lightness, its absorption of moisture, and its insulating properties.



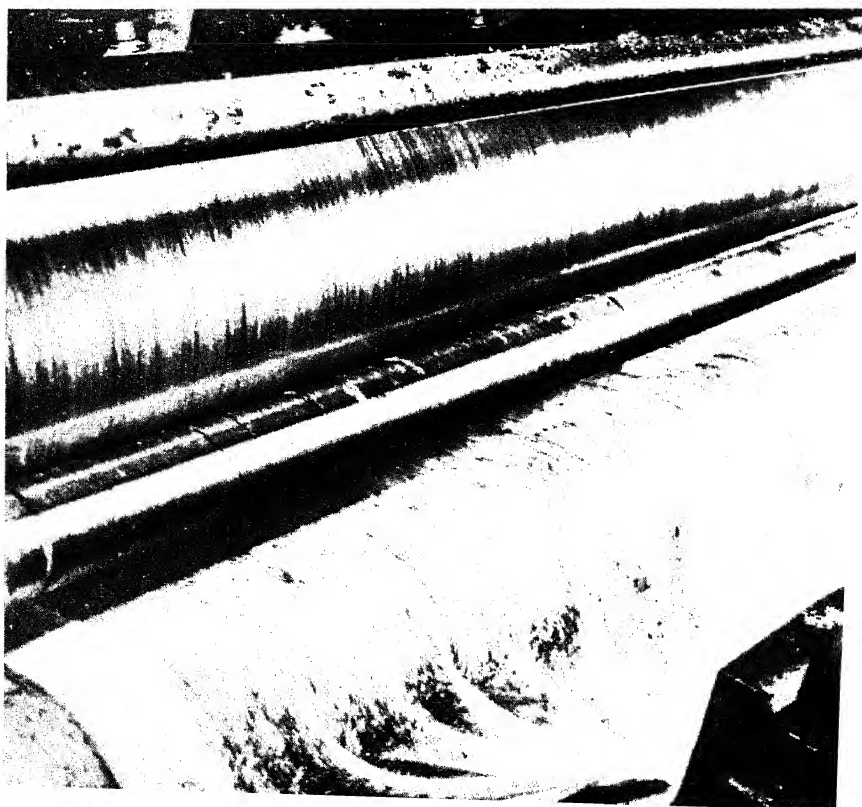
Using power-driven clippers operated from a truck, shearers clip the fleece close to the skin and remove it in one piece. The fleece is then pulled apart and the fibers sorted according to such characteristics as fineness or length. The average annual yield of wool is about 10 lb. per animal.

Wool Bureau



Above: After sorting, the fleece passes through a series of scouring bowls to remove impurities. In this process the fleece loses from 40 to 60 percent of its weight and yields lanolin as a by-product. Right: Dried in bins after scouring, the wool is conveyed to carding machines. Gradually the tangled fibers are smoothed out into a gossamer web, which is condensed and twisted into a fleecy white rope called a roving.

Wool Bureau



WOOL

Sources of Wool. Wild species of sheep bear a short, woolly undercoat covered by long, coarse, straight hair. The hair has entirely disappeared in domestic breeds; selective breeding has improved both the quality and abundance of wool. Other factors influencing wool production are nutrition, climate, and care. Neglected domesticated animals have a tendency to produce hair instead of wool.

The fleece of sheep raised for wool is generally shorn once yearly, in the spring or early summer. In regions where the climate is warm throughout the year, shearing may occur twice annually. The fleece is cut close to the skin, usually with mechanical shears, and removed in one piece. The average weight of the fleece shorn from better wool-producing breeds is about 10 lb. Small amounts of wool come from the skins of lambs slaughtered for meat.

Wool from different parts of the same fleece varies greatly in length of fiber, fineness, and structure. Wool from the shoulders and sides of the sheep is usually of superior quality to the

wool from other portions of the body. Quality varies also with the different breeds of sheep. Pure merino sheep bear the finest wool, and this type has been crossed with hardy sheep producing longer, coarser wool. About 40 percent of the world's total wool production consists of merino wool, and about 43 percent is obtained from crossbred varieties. The remaining portion is composed largely of carpet wools, which derive mostly from special types of sheep and are employed in the manufacture of blankets, carpets, and tapestries. In addition, a small quantity of fine wool used for apparel is obtained from animals other than the sheep. These wool-bearing animals include the camel, the alpaca, the Angora and Kashmir goats, the llama, and the vicuña (qq.v.).

Types and Labeling of Wool. The value of wool on the market depends primarily on fineness and length of fiber. Other factors include the strength, elasticity, amount of crimp, and uniformity. Two kinds of systems are followed in wool processing, the woollen system and the worsted system. In the woollen system the fibers are carded and then spun. In the worsted system, the fibers proceed to a combing process, which separates the long from the short fibers. The long fibers are then formed into smooth compact strands ready for spinning into yarn. Worsteds are not napped but are finished with a smooth surface. Uniform lengths of relatively fine fibers are of great importance in the worsted system because short fibers are difficult to spin. In the woollen system, on the other hand, fibers of mixed lengths may be used. Fine wools are classified according to the length of fiber. Longer fibers used in the manufacture of worsteds are called combing wool; shorter fibers employed for yarns used in soft, woven fabrics are known as carding wool.

In 1939, to protect the consumer, the United States Congress passed the Wool Products Labeling Act. This law requires that all fabric containing wool carry identification indicating the percentage of wool contained in the cloth. The act also specifies the proper legal description for the fiber according to category, such as new, reprocessed, or reused wool. New wool, or virgin wool, is wool that never before has been used in manufacture. Reprocessed wool refers to fiber reclaimed from woven wool scraps and clips accumulated from the cutting table, from samples, and from mill ends. These remnants, never previously used, are reconverted into a fibrous state and then reprocessed into the manufactured product. Reused wool is wool fiber recovered from products used by consumers,

Wool is woven into fine fabrics such as these fashionable Scottish tweeds.

Strellitz



respun, and rewoven. This category is less important now than formerly, because of contamination by synthetics.

Wool Production. Australia is the world's largest producer of raw wool, growing about one third of the total world supply. Other leading producers are the Soviet Union, New Zealand, Argentina, South Africa, the United States, and Uruguay. In the mid-1970's the annual U.S. wool production was estimated to total about 39,000,000 lb. when weighed before cleaning, mostly from sheep raised in Texas, Wyoming, California, Colorado, Montana, and Utah. All the carpet wool and more than one half of the apparel wool consumed in U.S. mills is imported from other countries.

Wool Manufacturing. The first step in the processing of wool preparatory to cloth making is the sorting of the fibers. As each fleece is pulled apart, the fibers are sorted into separate piles of similar nature and characteristics, mainly on the basis of fineness, length, and freedom from defects. After sorting, the fibers are cleaned, as wool contains an oily substance, called yolk, consisting of lanolin (see CHOLESTEROL) and suint, which is dried perspiration. The wool is scoured by a soap-alkali preparation or other detergent or solvent to remove the grease and other foreign substances.

The scoured wool fibers are disentangled and drawn straight into a continuous form in a process called carding and employing a carding machine. In this process the fibers are passed between pairs of rotating cylinders covered with a material called card clothing, which contains fine, pliable wire teeth. Upon emerging from the rollers, the wool is in the form of a thin film known as the web. The processing of the web varies according to whether woollen or worsted yarn is to be produced.

Woollen fabrics, such as tweeds, are woven from bulky yarns containing short wool fibers arranged at random, so that the fabric is relatively thick and has a fuzzy surface. Worsted fabrics, such as gabardines, are woven from yarns composed of longer, thinner wool fibers, tightly twisted to give the fabric a smooth surface.

For the production of woollen yarn the web is split into soft, thin strands called roving, and then it is ready to be spun. For worsted yarn the web is processed by machines that straighten the fibers, make them parallel, and remove all the short pieces. The resultant thick strand is then condensed by passing it through several machines until a very thin strand of worsted roving is obtained. From this type of roving can

be spun the smooth yarn that produces firm, smooth-textured worsted fabrics. See SPINNING.

See also CARPETS AND RUGS, CASHMERE, LOOM; TEXTILES

THE WOOL BUREAU, INC.

NEW YORK, N.Y.

WOOLF, Virginia (1882–1941), British author, born Adeline Virginia Stephen in London, England, and educated at home by her father, the British philosopher Sir Leslie Stephen (q.v.).



Virginia Woolf

Harcourt Brace Jovanovitch

About 1905, after the successive deaths of her mother and father, she and her sister Vanessa (1879–1961), an artist who later married the British critic Clive Bell (1832–1918), began to socialize with the former university colleagues of their older brother. The circle came to be known as the Bloomsbury group (q.v.); it included, in addition to Bell and other members of the London intelligentsia, Leonard Sidney Woolf (1880–1969), the British man of letters whom Virginia married in 1912.

Early Work. Mrs. Woolf's early novels *The Voyage Out* (1915), *Night and Day* (1919), and *Jacob's Room* (1922) offer increasing evidence of the author's determination to expand the scope of the novel beyond mere storytelling. In her next novels, *Mrs. Dalloway* (1925) and *To the Lighthouse* (1927), plot is nonexistent. Instead, psychological effects are achieved through the use of imagery, symbol, and metaphor. Character unfolds by means of the ebb

WOOLLCOTT

and flow of personal impressions, feelings, and thoughts, a stream-of-consciousness technique. Thus the inner lives of human beings and their otherwise average circumstances seem extraordinary. Influenced by the French philosopher Henri Bergson (q.v.), Mrs. Woolf, like the French writer Marcel Proust (q.v.), also involved herself in these novels with the concept of time. Although the events in *Mrs. Dalloway* take place within a fixed twelve-hour span, both books convey the passage of time through the moment-to-moment changes within the characters—their appreciation of themselves, others, and their kaleidoscopic worlds. In this way Mrs. Woolf created a metaphysical prose-poetry named by some critics as the most important contribution to the modern novel in English. Of her remaining fiction, the novel *The Waves* (1931) is the most evasive and stylized, and *Orlando: A Biography* (1928) departs somewhat from her usual technique by dealing in historical fantasy.

Critical Ability. Mrs. Woolf was a critic of considerable influence; her essays are gathered in such volumes as *The Common Reader: First Series* (1925) and *The Common Reader: Second Series* (1932). She also wrote biographies; and in *A Room of One's Own* (1929) she early espoused the cause of women's rights. Her posthumously published journals, collected in *A Writer's Diary* (1953), are of value to both aspiring writers and to readers of her fiction. In 1941, frightened by recurrent periods of mental illness, she committed suicide by drowning.

Leonard Woolf was joined by his wife Virginia in founding Hogarth Press, a publishing company, in 1917. His own work as journalist, author, and publisher influenced literary and political life for half a century. He also wrote an important five-volume autobiography: *Sowing* (1960), *Growing* (1961), *Beginning Again* (1964), *Downhill All the Way* (1967), and *The Journey Not the Arrival Matters* (1969).

WOOLLCOTT, Alexander (1887–1943), American writer and critic, born in Phalanx (near Red Bank), N.J., and educated at Hamilton College and Columbia University. He worked as drama critic for the *New York Times* (1914–22), the *New York Herald* (1922), and the *New York World* (1925–28), and was a contributor to *New Yorker* magazine (1929–39). From 1929 to 1942 Woollcott broadcast weekly radio reviews of drama and literature. His essays and stories have been collected in several volumes, including *While Rome Burns* (1934) and *Long, Long Ago* (1943). The American playwrights George S. Kaufman and Moss Hart (qq.v.) based their

comedy *The Man Who Came to Dinner* (1935) on Woollcott's flamboyant and caustic personality, and Woollcott played in the title role.

WOOLLEY, Mary Emma (1863–1947), American educator, born in South Norwalk, Conn., and educated at Brown University. From 1886 to 1891 she taught at Wheaton Female Seminary (now Wheaton College, Norton, Mass.). In 1894 she became the first woman to graduate from Brown University (q.v.). She taught biblical history and literature at Wellesley College (q.v.) from 1895 to 1900. She became president of Mount Holyoke College (q.v.) in 1900, retaining that position until her retirement in 1937. During her tenure at Mount Holyoke she became one of the most prominent educators in the United States. She was also active in the world peace cause and wrote several historical monographs.

WOOLMAN, John (1720–72), American Quaker leader, writer, and social reformer, born near Mount Holly, N.J., and self-educated. He earned his living chiefly as a tailor. After about 1743 he traveled throughout the colonies spreading the teachings of the Quakers. Woolman was especially eloquent in his opposition to slavery (q.v.). His tract *Some Considerations on the Keeping of Negroes* (part I, 1754; part II, 1762) was one of the first abolitionist documents written in America. He was largely instrumental in persuading the American Quakers to oppose slaveholding; see FRIENDS, SOCIETY OF. Outstanding among Woolman's writings is the *Journal* (1774), an account of his spiritual life, which is considered a classic literary work. The best-known edition of the *Journal* is the one edited in 1871 by the American poet John Greenleaf Whittier (q.v.).

WOOLWORTH, Frank Winfield (1852–1919), American merchant, born in Rodman, N.Y. He briefly attended a business college in Watertown, N.Y. After failing in a number of business enterprises, he opened a store in Lancaster, Pa., in 1879 which specialized in the sale of items priced at five and ten cents. Thereafter Woolworth opened similar stores throughout the United States and in several foreign countries, increasing the variety of his goods and offering many articles previously available only at higher prices. The F. W. Woolworth Company owned over 1000 five-and-ten-cent stores when it was incorporated in 1911. The Woolworth Building on lower Broadway in New York City, built to house the executive offices of the firm, was designed by the American architect Cass Gilbert (q.v.), and completed in 1913; standing 792 ft., it was then the tallest building in the world; see



The first "5 and 10c store" in the U.S., opened by F. W. Woolworth in 1879 at Lancaster, Pa. F. W. Woolworth Co.

AMERICAN ARCHITECTURE At the time of his death, Woolworth had amassed a personal fortune estimated at \$65,000,000.

See also **CHAIN STORES**.

WOONSOCKET, city of Rhode Island, in Providence Co., on the Blackstone R., about 13 miles NW of Providence. Woonsocket is an industrial center engaged principally in the milling of textiles, notably woolen and worsted cloth. Synthetic yarns, rubber goods, machine and precision tools, plastics, and electrical implements also are manufactured. Woonsocket developed around a riverside sawmill established in 1666. Originally a part of the town of Cumberland, it was incorporated as a separate town in 1867 and chartered as a city in 1888. Pop. (1960) 47,080; (1970) 46,820.

WOOSTER, city in Ohio, and county seat of Wayne Co., on the Killbuck Creek, about 30 miles W of Canton. Manufactures include metal products, paints, and machinery. It is the site of the College of Wooster, founded in 1866.

Nearby is a State agricultural experiment station. Wooster was founded in 1808, named in honor of David Wooster (1711-77), a Revolutionary war general. The city was incorporated in 1817. Pop. (1960) 17,046; (1970) 18,703.

WORCESTER, city and port of entry in Massachusetts, and a county seat of Worcester Co., on the Blackstone R., about 40 miles W of Boston, it is bordered on the E by Lake Quinsigamond. The second-largest city in the State, it is an important industrial and transportation center. Among the manufacturing establishments in the city are plants producing steel, wire, machine tools, textiles, and leather goods. A number of large insurance companies maintain their headquarters in Worcester.

The city is noted also for its educational and cultural institutions. The former include Worcester Academy (1832), College of the Holy Cross (1843), Assumption College (1904),

WORCESTER

Worcester Polytechnic Institute (1865), a State teachers college (1871), Clark University (1887), and Worcester Junior College (1938). The American Antiquarian Society (1812) and the Art Museum (1896) contain valuable collections, and the natural history and historical societies maintain museums. The annual Worcester Music Festival dates from 1858.

A settlement called Quinsigamond Plantation was established on the site of present-day Worcester about 1673, but upon the outbreak of King Philip's War in 1675 (see PHILIP) it was abandoned. In 1684 the site was resettled and named Worcester (from Worcester, England). It, too, was abandoned (1702), because of difficulties with the Indians. The permanent settlement dates from 1713; it was incorporated as a town in 1780. Worcester courthouse was closed by the rebels during Shay's Rebellion (q.v.). The development of water power and the canalization of the Blackstone R. early in the 19th century provided the basis for the industrial growth of Worcester. It was incorporated as a city in 1848. Pop. (1960) 186,587; (1970) 176,572.

WORCESTER, Great Britain, county borough and administrative center of Worcestershire, England, on the Severn R., about 100 miles N.W. of London. Worcester is the center of a leather-glove industry dating from the 15th century and is noted also for the manufacture of fine porcelain and the condiment Worcestershire sauce. Other manufactures include railroad equipment and farm machinery. An extensive trade in hops, wine, and vinegar is carried on. Three county fairs are held annually in the borough. Worcester is an episcopal city, one of the fourteen cathedral cities in England. Worcester cathedral, the cathedral Church of Our Lord and the Blessed Virgin Mary, is of 11th-century origin. Its oldest parts are the remains of a Norman-style church built (1062–95) by Wulfstan (1009?–95?), bishop of Worcester, near the site of a monastic cathedral completed in 983 by Saint Oswald of York (d. 992). Most of the present structure, which was restored in the 19th century, dates from the 13th and 14th centuries. The cathedral represents every style of medieval English architecture, having portions designed in the Norman, early English Gothic, decorated Gothic, perpendicular Gothic, and Tudor Gothic periods. The length of the edifice is 425 ft., the width 145 ft., and the height of the nave 68 ft. A pinnacled tower 196 ft. high is the most ornamented part of the exterior. The cathedral is the burial place of King John (q.v.) and of Prince Arthur (1486–1502), son of King Henry VII (q.v.).

Other structures of historical and architec-

tural interest are eleven parish churches; the Commandery, founded as a hospital in 1085; the King's School, founded in 1541; many old houses of half-timber construction; and the guildhall, erected in 1723. The Royal Grammar School, founded by Queen Elizabeth I (q.v.), occupies a modern building. Local institutions include a grain exchange and a museum of natural history.

History. After occupation by Britons and Romans, Worcester became (about 680) an episcopal see. The town underwent many attacks because of its strategic position on the Welsh frontier. Before 1200 it was twice invaded by Danes and five times partly burned. During the Great Rebellion (q.v.) it was besieged, taken, and plundered by Parliamentary armies in 1642 and again in 1646. In the Battle of Worcester, fought on Sept. 3, 1651, a Parliamentary army commanded by Oliver Cromwell (see *under* CROMWELL) won a conclusive victory over the Scottish royalists led by King Charles II (q.v.). Worcester received its first charter in 1554 from the English queen Mary I (q.v.). The city was made a county borough in 1835. Pop. (1971) 73,445.

WORCESTER, Joseph Emerson (1784–1865), American lexicographer, born in Bedford, N.H., and educated at Yale College (now Yale University). He first published geographical and historical books, many of which were widely used as textbooks. In 1828 he began publishing dictionaries and in 1830 he issued his own dictionary, the *Comprehensive Pronouncing and Explanatory Dictionary of the English Language*. His most important work was *A Dictionary of the English Language* (1860), the first American dictionary containing illustrations. Until the late 19th century Worcester's dictionaries rivaled those of the American lexicographer Noah Webster (q.v.). Worcester's works adhered to traditional British usage and were popular with the highly educated, while Webster's works were more innovative and contained many Americanisms.

WORCESTERSHIRE, Great Britain, county of W. central England bounded on the N. by Shropshire and Staffordshire, on the E. by Warwickshire, on the S. by Gloucestershire, and on the W. by Herefordshire. Most of the terrain is a gently undulating plain. The chief rivers are the Severn, Avon, and Stour. In the S.W. the Malvern Hills rise to a height of about 1400 ft. Largely agricultural, the county has rich pasture land, and fruit orchards and truck gardens are centered in the Avon valley (known as the Vale of Evesham). The N. section is part of the so-called black

country, a region noted for iron and steel manufactures. Among other manufactures of the county are carpets, rugs, glass, gloves, porcelain, and the famous Worcestershire sauce. There are deposits of salt, clay, coal, and iron. Worcester (q.v.) is the administrative center. Other important towns are Kidderminster (q.v.) and Stourbridge. The region comprising present-day Worcestershire was settled in the 6th century by the Hwiccas, an Anglo-Saxon tribe. In later times it formed part of the Anglo-Saxon kingdom of Mercia. Worcestershire was constituted an administrative unit about the middle of the 11th century. It figured prominently in the monastic movement during the Middle Ages (q.v.). Area, 699.9 sq.mi.; pop. (1971) 692,605.

WORDEN, John Lorimer (1818–97), American naval officer, born in Westchester County, N.Y. He entered the United States Navy as a midshipman in 1834. In January, 1862, during the American Civil War, he took command of the Union ironclad *Monitor* (q.v.). Three months afterward, the *Monitor* met the Confederate ironclad *Merrimac* (q.v.) in a historic battle in the Virginia harbor and channel known as Hampton Roads (q.v.). This first conflict between ironclads lasted about four hours and was indecisive. For his conduct of the battle, Worden received national acclaim, and the following year he was promoted to captain. He commanded the Union ironclad *Montauk* from October, 1862, to April, 1863. From 1869 to 1874 Worden was superintendent of the United States Naval Academy, and from 1875 to 1877 he headed the European Squadron of the U.S. Navy. He was promoted to rear admiral in 1872, and he retired in 1886.

WORDSWORTH, name of two British writers, brother and sister, he primarily a poet and she important largely as a diarist, both invaluable contributors to English literature (q.v.) produced in the 18th and 19th centuries.

William Wordsworth (1770–1850), born in Cockermouth, Cumberland, England, and educated at St. John's College, University of Cambridge. He developed a keen love of nature as a youth, and during school vacation periods he frequently visited places noted for their scenic beauty. In the summer of 1790 he took a walking tour through France and Switzerland with a Cambridge friend. After receiving his degree in 1791 he returned to France, where he became an enthusiastic convert to the ideals of the French Revolution. While in France he fell in love with Marie-Ann ("Annette") Vallon of Orléans (b. 1766), who bore him a daughter in December, 1792, shortly before his return to Eng-

land. Wordsworth was disheartened by the outbreak of hostilities between France and Great Britain in 1793, but he remained sympathetic to the French cause.

Although Wordsworth had begun to write poetry while still a schoolboy, none of his poems was published until 1793, when *An Evening Walk* and *Descriptive Sketches in Verse* appeared. These works, although fresh in content, reflect the influence of the formal style of 18th-



William Wordsworth

century English poetry. The poems received little notice, and few copies were sold.

Wordsworth's income from his writings amounted to little, so the problem of finances was an acute one. The situation was alleviated for a time when in 1795 he received a bequest of £900 from a close friend. Thereupon he and his sister Dorothy (see below) went to live in Racedown, Dorsetshire. The two had always enjoyed a warmly sympathetic relationship, and Wordsworth relied greatly upon Dorothy, his devoted confidante, for encouragement in his literary endeavors. Her mental breakdown in later years was to cause him great sorrow, as did the death of his brother John Wordsworth (1772–1805). William had met the poet Samuel Taylor Coleridge (see under COLERIDGE), an enthusiastic admirer of his early poetic efforts, and in 1797 he and Dorothy moved to Alfoxton Park, Somersetshire, near Coleridge's home in Nether

WORDSWORTH

Stowey. The move marked the beginning of a close and enduring friendship between the poets. In the ensuing period they collaborated on a book of poems entitled *Lyrical Ballads*, first published in 1798.

This work is generally taken to mark the beginning of the Romantic movement in English poetry; see ROMANTICISM. Wordsworth wrote almost all of the poems in the volume, including the memorable "Lines Composed a Few Miles Above Tintern Abbey"; Coleridge contributed the famous "Rime of the Ancient Mariner". Representing a revolt against the artificial classicism of contemporary English verse, *Lyrical Ballads* was greeted with hostility by most leading critics of the day.

In defense of his unconventional theory of poetry, Wordsworth wrote a Preface to the second edition of the *Ballads*, which appeared in 1800. His premise was that the source of poetic truth is the direct experience of the senses. Rejecting the contemporary emphasis on form and upon an intellectualized approach that drained poetic writing of strong emotion, he maintained that the scenes and events of everyday life and the speech of ordinary people were the raw material of which poetry could and should be made. Far from conciliating the critics, the Preface served only to increase their hostility. Yet Wordsworth was not discouraged; he continued to write poetry which graphically illustrated the principles he expounded.

Prior to the publication of the Preface, Wordsworth and his sister had accompanied Coleridge to Germany in 1798-99. There he wrote several of the "Lucy" poems and began *The Prelude*. Written to investigate Wordsworth's abilities as a philosophic poet, *The Prelude* was completed in 1805 and, after substantial revision, published posthumously in 1850. Many critics rank it as Wordsworth's greatest work, viewing it as an epic of spiritual discovery in the tradition of the *Divine Comedy* by the Italian poet Dante (q.v.).

Returning to England, William and his sister settled in 1799 at Dove Cottage in Grasmere, the loveliest spot in the English Lake District; the British poet Robert Southey (q.v.) as well as Coleridge lived nearby. The three men became known as the Lake Poets (q.v.). In 1802 Wordsworth married Mary Hutchinson (1770-1859), a childhood friend, who is portrayed in the charming lyric "She Was a Phantom of Delight". The same year the economic position of the Wordsworths improved when the earl of Lonsdale repaid an old family debt amounting to more than £4000.

In 1807 *Poems in Two Volumes* was published. The work contains much of Wordsworth's finest verse, notably the superb "Ode on Intimations of Immortality" and the autobiographical narrative "Resolution and Independence".

In 1813 Wordsworth obtained a sinecure as distributor of stamps for Cumberland and Westmorland at a salary of £500 a year. In the same year he and his family and sister moved to Rydal Mount, a few miles from Dove Cottage, and there the poet spent the remainder of his life, except for periodic travels throughout the British Isles and on the Continent.

Wordsworth's political and intellectual sympathies underwent a transformation after 1800. By 1810 his viewpoint was staunchly conservative. He was disillusioned by the course of events in France culminating in the rise of Napoleon I; his circle of friends, including the Scottish author Sir Walter Scott (qq.v.), also influenced him in the direction of orthodoxy.

Many of Wordsworth's later poems are generally undistinguished and prosaic to the point of dullness; however, a number of them are illumined by the spark of his former greatness. Between 1814 and 1822 his publications included *The Excursion* (1814), a continuation of *The Prelude* but lacking the power and beauty of that work; *The White Doe of Rylstone* (1815); *Peter Bell* (1819); and *Ecclesiastical Sonnets* (1822). *Yarrow Revisited and Other Poems* appeared in 1835, but after 1835 Wordsworth wrote few new poems.

Wordsworth is one of the great British poets. Much of his conversational blank verse has true lyrical power and grace, and his finest work is permeated by a sense of man's relation to external nature that is religious in its scope and intensity. To Wordsworth, God was everywhere manifest in the harmony of nature, and he felt deeply the kinship between nature and the soul of man.

The tide of critical opinion turned in his favor after 1820, and Wordsworth lived to see his work universally praised. In 1842 he was awarded a government pension and in the following year he succeeded Southey as poet laureate (q.v.). Wordsworth died at Rydal Mount, April 23, 1850, and was buried in the Grasmere churchyard.

Among Wordsworth's other poetic works are *The Borderers: a Tragedy* (1796; published, 1842); *Michael* (1800); *The Recluse* (1800; published, 1888); *Laodamia* (1815); and *Memorials of a Tour on the Continent* (1822). Wordsworth also wrote the prose works *Convention of Cin-*

ma (1809) and *A Description of the Scenery of the Lakes in the North of England* (1810; republished with additions, 1822).

Dorothy Wordsworth (1771–1855), born in Cockermouth, Cumberland, England. Beginning in 1795 she kept house for her brother at Race-down, Alfoxton Park, and Grasmere. Her *Journals*, begun in January, 1798, describe the Wordsworths' household, their friends, and their travels in Scotland, through the Lake District in England, and on the Continent. These accounts are valuable as source material for students and biographers of William, frequently offering illuminating insights into the themes and inspirations of his early poetry. The *Journals* are also first-rate literature in their own right, as perceptive descriptions of nature and people written in a sensitive, poetic style. In 1829 Dorothy suffered a severe nervous breakdown; she spent the rest of her life in a state of mental and physical collapse.

M.G.S.

WORK, in physics, product of a force applied to a body and the displacement of the body in the direction of the applied force (q.v.). While work is done on a body, there is a transfer of energy (q.v.) to the body, and so work can be said to be energy in transit. The units of work are identical to those of energy. If, for example, an object is lifted from the floor to the top of a table, work is done in overcoming the downward force of gravity and the energy imparted to the body as work will increase its potential energy; see GRAVITATION. Work is also expended when a force accelerates a body, such as the acceleration (q.v.) of an airplane because of the thrust forces developed by its jet engines; see JET PROPULSION. The force need not be simply a mechanical force (see MECHANICS) as in the case of lifting a body or accelerating a plane by jet reaction; it can also be an electro-static, electro-dynamic or surface tension (q.v.) force; see ELECTRICITY: *Electrostatics*. On the other hand, if a constantly acting force does not produce motion, no work is performed. Holding a book steadily at arm's length, for example, does not involve any work, irrespective of the apparent effort required.

In the commonly used English system of units, the unit of work is the ft.-lb. (force), which is equal to the amount of work required to raise a mass of 1 lb. through an elevation of 1 ft. at sea level and 45° latitude. In the G.G.S. system (q.v.), a force of 1 dyne moving through 1 cm corresponds to 1 erg of work. The more commonly used practical unit of work or energy in the G.G.S. system is the joule, which equals 10⁷ ergs. The rate of doing work is known as the

power (q.v.). The application of 550 ft.-lb. per sec. for example, corresponds to 1 horsepower (q.v.), abbreviated h.p., in the English system.

F.La.

WORK, Henry Clay (1832–84), American songwriter, born in Middletown, Conn., and self-taught in music. During the American Civil War he became a writer of popular songs, among them "Kingdom Coming" (1861) and "Marching Through Georgia" (1865). He also wrote the famous temperance song, "Father, Dear Father, Come Home with Me Now" (1864).

WORKMEN'S COMPENSATION, in law, payment made to employees by employers, in accordance with statutory provisions, for injuries and disabilities incurred in the course of employment.

In many countries, prior to the enactment of legislation compelling employers to insure their employees for injuries sustained by them in the course of their employment, the employee had the right only to bring an action at law against the employer to obtain damages for such injuries. In such a legal action the employee had to prove that he was not himself responsible for the accident, that no fellow worker was responsible, and that the accident that resulted in the injury was not a normal risk of the industry; the worker also had to prove the nature and extent of his injury. The result was that only a small proportion of injuries were ever compensated, with consequent serious social effects on injured workers and their families.

About the middle of the 19th century, agitation developed for a program of compulsory compensation of injured employees by employers whether or not the employee was in any way responsible for the accident. The earliest compulsory accident-insurance law was that enacted by Germany in 1884; Great Britain followed in 1897, and the United States in 1908. Today some form of compulsory workmen's compensation is in force in practically all industrialized countries; in the U.S. the Federal government and every State have enacted compensation laws.

Coverage. Under workmen's-compensation legislation scales of compensation are established for accidental injuries arising out of and in the course of employment, regardless of whom is responsible therefor. The scope of coverage varies in the different jurisdictions with respect to benefits payable in case of death, of total disability, and of partial disability due to specific injuries or continuing during specified periods. Administrative requirements compel reporting of all accidents to a public board

WORK PROJECTS ADMINISTRATION

charged with the responsibility for making compensation awards to workmen if injured, or in case of death, to his family. In recent years State workmen's-compensation statutes have been broadened to provide for coverage of occupational diseases (q.v.).

In many States the compensation laws are not compulsory but elective, that is, the employer may elect to be governed by the provisions of the act. If he does not elect to be so governed, he cannot assert as a defense to the employee's action for damages the employee's contributory negligence (see NEGLIGENCE), or that the accident was due to the actions of a fellow employee, or that the accident was a normal risk of the business.

Cost. Compensation protection places a high charge upon the operating costs of industry. Stringent safety programs instituted by the major corporations have nevertheless failed to stop the rise in industrial accident rates. It was estimated in 1972 that industrial accidents cost manufacturers \$11,500,000,000 annually. Experts of the National Safety Council recently declared that 85 percent of all industrial accidents were preventable if proper safety rules were enforced, and that another 10 percent were due to improper physical conditions in the plants. Workmen's compensation paid out in the U.S. in 1973 amounted to about \$5,063,000,000, with private carriers accounting for \$2,513,000,000, State funds for \$1,966,000,000, and self-insurers for \$584,000,000. See HEALTH INSURANCE; INSURANCE; SOCIAL LEGISLATION.

A.Tr.

WORK PROJECTS ADMINISTRATION, originally WORKS PROGRESS ADMINISTRATION, (W.P.A.), former agency of the United States government. The W.P.A. was established in May, 1935, to cope with unemployment problems created by the economic depression which began in 1929. The name was changed in July, 1939.

In cooperation with State and local governments and private businesses, the W.P.A. conducted a broad program of public works and community services. During its existence it provided employment for about 8,500,000 Americans.

Approximately 80 percent of its activities took place in the field of public works and construction. Agency projects included the building or improvement of more than 664,000 miles of roads, 285 airports, 24,000 miles of sewage lines, and 120,000 public buildings. Other activities were the construction of parks, playgrounds, irrigation systems, tunnels, and many similar public facilities.

In the field of community service the W.P.A.'s educational achievements were especially outstanding. The adult education program of the agency provided employment for more than 44,000 teachers and instruction for more than 1,700,000 persons. The National Youth Administration enabled thousands of young people to finish their education. The agency also provided many millions of school lunches for undernourished children. In addition, the W.P.A. sponsored art, theater, music, and writing projects. During World War II it maintained nurseries for the children of women engaged in defense work, and trained many thousands of persons for jobs as skilled defense workers. During the seven years of its operation the agency expended about \$10,500,000,000. The W.P.A. was liquidated in June, 1943.

See NEW DEAL; UNEMPLOYMENT: *Remedies for Unemployment*.

WORLD. See EARTH.

WORLD BANK. See INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT.

WORLD COUNCIL OF CHURCHES, international organization of Protestant, Anglican, Old Catholic, and Orthodox churches, founded in 1948 to promote ecumenical fellowship, service, and study. It is defined by its constitution as "a fellowship of churches which confess the Lord Jesus Christ as God and Saviour according to the Scriptures and therefore seek to fulfill together their common calling to the glory of the one God, Father, Son and Holy Spirit" (see TRINITY).

Principal authority is vested in an assembly of delegates, which meets every six or seven years. Between assembly meetings authority is exercised by a 135-member central committee, which is elected by the assembly and normally meets annually. A permanent secretariat, headed by a general secretary, administers the program of the council, whose decisions are not binding on the member churches. Council headquarters is in Geneva, Switzerland, and an office also is maintained in New York City.

Major units of organization include commissions on Inter-Church Aid, Refugee, and World Service; Faith and Order; World Mission and Evangelism; and the Churches' Participation in Development; the Commission of the Churches on International Affairs; and programs supporting a dialogue on living faiths and ideologies and an ecumenical effort against racism.

The founding assembly of the World Council was held in Amsterdam, the Netherlands, in August, 1948. Representatives of 150 churches from 44 countries attended. The Second Assembly, held in Evanston, Ill., in August, 1954, was at-

WORLD HEALTH ORGANIZATION

tended by 1242 delegates and accredited visitors representing 163 churches in 49 countries. Almost 200 member churches in 84 countries were represented at the Third Assembly, held in New Delhi, India, in December, 1961. At this assembly the International Missionary Council merged with the World Council, forming the Division of World Mission and Evangelism.

The Fourth Assembly, held in Uppsala, Sweden, in July, 1968, was attended by some 2000 delegates, delegated observers, official visitors, youth participants, staff, and others. At Nairobi, Kenya, 747 voting delegates represented 271 member churches in the Fifth Assembly, held from Nov. 23 to Dec. 10, 1975. During the 1975 assembly, more new churches were accepted into membership, bringing the total to 279 churches, representing some 100 countries and territories and more than 400,000,000 individual members.

See CHURCH OF ENGLAND; ECUMENICAL MOVEMENT; OLD CATHOLICS; ORTHODOX CHURCH; PROTESTANTISM.

WORLD COURT, popular name for the International Court of Justice (q.v.).

WORLD FOOD PROGRAM, unit of the United Nations (q.v.), created in 1961 by the General Assembly as a three-year experimental project of the U.N. and the Food and Agriculture Organization of the United Nations (q.v.). In 1965 the assembly voted to extend the pro-

gram "for as long as multilateral food aid is found feasible and desirable".

The purpose of the World Food Program (W.F.P.) is to expedite relief work in emergency or natural-disaster areas. In cooperation with the Food and Agriculture Organization and other U.N. agencies, the W.F.P. distributes food supplies after disasters and provides cash for emergencies and for wages of workers on rescue or rehabilitation projects.

The resources of the program are provided through voluntary governmental contributions of commodities or of services such as shipping and of cash, which must amount to one third of the total contribution. Annual goals set for the W.F.P. are consistently oversubscribed. The quota set for 1973-74 operations was \$340,000,000, 78 percent of which was pledged by forty-four nations in a conference on Jan. 31, 1972. Other countries indicated future contributions that would meet or surpass the goal. K.M.

WORLD HEALTH ORGANIZATION, specialized agency of the United Nations (q.v.), with its headquarters in Geneva, Switzerland. The World Health Organization (W.H.O.) was established in 1948 and according to its constitution is "the directing and coordinating authority on international health work", and is responsible

The World Health Organization provides aid at the Tripoli Nursing School where young women from all parts of Libya are trained as nurses.

United Nations





The worldwide control of malaria is a high-priority goal of the W.H.O. At a village in Kenya, members of a malaria spray team work to check the spread of the disease.

World Health Organization

for helping all peoples to attain "the highest possible level of health". In 1972 there were 136 member countries and 3 associate members of the agency.

The services of the agency may be either advisory or technical. Advisory services include aid in training medical personnel and in disseminating knowledge of such subjects as influenza, malaria, smallpox, tuberculosis, venereal diseases, maternal and child health, nutrition, population planning, and environmental sanitation. The agency maintains health-demonstration areas for sustained application of modern techniques to improve general health conditions and to combat specific diseases interfering with agricultural productivity and overall economic development. The technical services include biological standardization and unification of pharmacopoeias, collection and dissemination of epidemiological information, special interna-

tional research projects on parasitic and virus diseases, and publication of a series of fifteen types of technical and scientific works.

The central structure of W.H.O. comprises the policy-making body called the World Health Assembly, which consists of delegates of all member nations and meets annually; an executive board, composed of twenty-four persons designated by as many members; and a secretariat, consisting of a director-general and a technical and administrative staff. The agency maintains regional organizations for southeast Asia, the eastern Mediterranean area, Europe, Africa, the Americas, and the western Pacific area.

WORLD METEOROLOGICAL ORGANIZATION, known as W.M.O., specialized agency of the United Nations, established in 1947 to coordinate, standardize, and improve world meteorological information. Successor to the International Meteorological Organization, which had coordinated weather-reporting services among its members after 1878, the W.M.O. in 1970 had 132 members, consisting of countries and territories which maintain meteorological

services. The organization facilitates international cooperation in the establishment of station networks and centers to provide meteorological and hydrometeorological services and observations. It promotes the establishment of systems for the rapid exchange of weather data and the standardization of meteorological observations, and encourages research and training to further the application of meteorology to aviation, shipping, agriculture, and other activities.

The organizational structure of W.M.O. includes the policy-making body called the World Meteorological Congress, in which all members are represented by the directors of their respective meteorological services, and which meets at least once every four years; the executive committee, which carries out the resolutions of the Congress, initiates studies, and makes recommendations on matters requiring international action; regional meteorological associations for the six regions, these being, Africa, Asia, South America, North and Central America, Europe, and the Southwest Pacific; and technical commissions composed of experts in such fields as atmospheric sciences, climatology, and maritime meteorology. The secretariat, which is headed by a secretary-general, has its headquarters in Geneva, Switzerland.

J.A.J. & K.M.

WORLD SERIES. See **BASEBALL**.

WORLD WAR I, war, from 1914 to 1918, that began as a local European conflict between Austria-Hungary and Serbia on July 28, 1914; was transformed into a general European war by the declaration of war made by Germany against Russia, Aug. 1, 1914; and eventually became a global war involving thirty-two nations. Twenty-eight of these nations, known as the Allies and the Associated Powers, and including Great Britain, France, Russia, Italy, and the United States, opposed the coalition known as the Central Powers (q.v.), consisting of Germany, Austria-Hungary, Turkey, and Bulgaria. The immediate cause of the war between Austria-Hungary and Serbia was the assassination on June 28, 1914, at Sarajevo, capital of the Austro-Hungarian province of Bosnia, of the Archduke Francis Ferdinand, heir-presumptive to the throne of Austria-Hungary, by Gavrilo Princip (1893?–1918), a Serb nationalist. The fundamental causes of the conflict, however, were rooted deeply in the European history of the previous century, particularly in the political and economic policies of the nations of Europe after the year 1871, which marked the emergence of Germany as a great world power.

CAUSES OF THE WAR

The underlying causes of World War I were the spirit of intense nationalism (q.v.) that prevailed in Europe throughout the 19th and early 20th centuries, the political and economic rivalry among the nations, and the establishment and maintenance in Europe after 1871 of large armaments and of two hostile military alliances.

Nationalism. The French Revolution (q.v.) and the Napoleonic era (see **NAPOLEON I**) had spread throughout most of Europe the idea of political democracy, with the resulting idea that people of like ethnic origin and with the same language and political ideals had the right to independent nationality. The principle of national self-determination, however, was largely ignored by the dynastic and reactionary forces that dominated in the settlement of European affairs at the Congress of Vienna in 1815; see **VIENNA, CONGRESS OF**. A number of peoples who desired nationality of their own were made subject to local dynasts or to other nations. Notable examples were the German people, whom the Congress of Vienna left divided into numerous duchies, principalities, and kingdoms; Italy, also left divided into a number of parts, many of which were under foreign control; and the Flemish- and French-speaking Belgians of the Austrian Netherlands, whom the Congress placed under Dutch rule. Revolutions and strong nationalistic movements during the 19th century succeeded in nullifying much of the reactionary and anti-nationalistic work of the Congress. Belgium won its independence from the Netherlands in 1831; the unification of Italy was accomplished in 1861; and that of Germany in 1871. At the close of the century, however, the problem of nationalism was still unresolved in a number of areas in Europe, resulting in tensions both within the regions involved and between various European nations. For a discussion of the individual areas and their history, see **AUSTRIA-HUNGARY**; **EUROPE: History: Modern: The 20th Century: World War I**; and separate articles on individual countries. One particularly prominent nationalistic movement, Pan Slavism, figured heavily in the events preceding the war; see **BALKAN PENINSULA**; **BALKAN WARS**; **SLAVS**.

Imperialism. The spirit of nationalism in Europe was also manifest in economic conflict. The industrial revolution (q.v.), which took place in Great Britain at the end of the 18th century, in France beginning about 1830, and in Germany beginning about 1870, caused an immense increase in the manufactures of each country and a consequent need for foreign markets; see **IMPERIALISM**. The principal field for the

WORLD WAR I

European policies of economic expansion was Africa, and on that continent colonial interests frequently clashed. Several times between 1898 and 1914 the economic rivalry in Africa between France and Great Britain, and between Germany on one side and France and Great Britain on the other, almost precipitated a European war; see FASHODA INCIDENT; also see below, *The Crises Foreshadowing the War, 1905–14*.

Military Expansion. As a result of the tensions described above, nations of Europe adopted domestic measures and foreign policies that in turn steadily increased the danger of war. Between 1871 and 1914 the nations, convinced that their interests were being threatened, maintained large standing armies. These they constantly replenished and augmented by peacetime conscription; and at the same time, they increased the size of their navies. The naval expansion was intensely competitive. Great Britain, influenced by the expansion of the German navy begun in 1900 and by the events of the Russo-Japanese War (q.v.), developed its navy under the direction of Admiral Sir John (later Lord) Fisher. The war between Russia and Japan had proved the efficacy of long-range naval guns, and the British accordingly developed the widely copied “dreadnought” battleship, notable for its heavy armament. Accompanying developments in other areas of military technology and organization led to the dominance of general staffs with precisely formulated plans for mobilization and attack, often in situations that could not be reversed once begun.

Statesmen everywhere realized that the tremendous and ever-growing expenditures for armament would in time lead eventually to national bankruptcy or to war, and they made several efforts for worldwide disarmament, notably at the Hague Conferences (q.v.) of 1899 and 1907. International rivalry was, however, too far advanced to permit any progress toward disarmament at these conferences.

The European nations not only armed themselves for purposes of “self-defense”, but, in order not to find themselves standing alone if war did break out, sought alliances with other powers. The result was a phenomenon that in itself greatly increased the chances for war: the grouping of the great European powers into two hostile military alliances, the Triple Alliance and the Triple Entente (qq.v.). Shifts within these alliances added to the building sense of crisis.

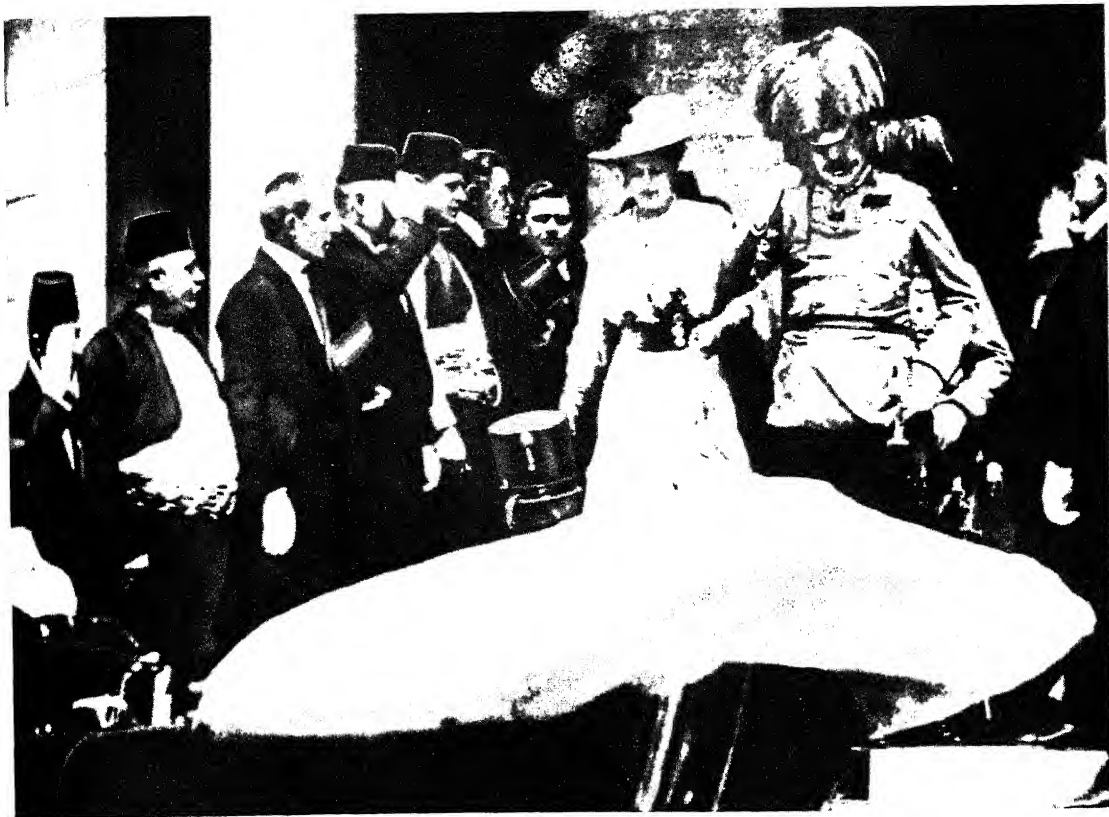
The Crises Foreshadowing the War (1905–14). With Europe divided into two hostile camps, every disturbance of the existing political or military situation in Europe, Africa, and else-

where brought on an international incident. Between 1905 and 1914 several international crises and two local wars occurred, all of which threatened to bring about a general European war. The first crisis occurred over Morocco; there in 1905–06 Germany intervened to support Moroccan independence against French economic and political penetration. France threatened war against Germany, but the crisis was finally settled by an international conference at Algeciras, Spain, in 1906. The second crisis took place in the Balkans in 1908 over the annexation by Austria-Hungary of Bosnia and Hercegovina (q.v.). Because one form of Pan Slavism was a Pan-Serbian or Greater Serbia movement in Serbia, which had as one of its objects the acquisition by Serbia of the southern part of Bosnia, the Serbs threatened war against Austria. War was avoided only because Serbia could not fight without Russian support, and Russia at the time was unprepared for war. A third crisis took place again in Morocco, in 1911, when the German government sent a warship to Agadir (q.v.) in protest against French efforts to secure supremacy in Morocco. After threats of war on both sides, the matter was adjusted by a conference at Agadir. Taking advantage of the preoccupation of the Great Powers with the Moroccan question, in 1911 Italy, hoping to annex the Tripoli region of northern Africa, declared war on Turkey. Because its policy of *Drang nach Osten* (“drive toward the East”) obliged Germany to cultivate friendship with Turkey, the Italian attack on the latter country had the effect of weakening the Triple Alliance and encouraging its enemies. The Balkan Wars of 1912–13 resulted in an increased desire on the part of Serbia to obtain the parts of Austria-Hungary inhabited by Slavic peoples, strengthened Austro-Hungarian suspicion of Serbia, and left Bulgaria and Turkey, both defeated in the wars, with the desire for a war of revenge. Germany, disappointed because Turkey had been deprived of its European territory by the Balkan Wars, increased the size of its army. France responded by increasing peacetime military service from two to three years. Following the example of these nations, all the others of Europe in 1913 and 1914 spent huge sums for military preparedness.

THE MILITARY CAMPAIGNS

On a Europe thus heavily armed and torn by national rivalries and jealousies, the assassination of the Austrian archduke had a catastrophic effect.

The Outbreak of War. The assassination caused an immediate crisis between Austria-



The Archduke Francis Ferdinand, heir-presumptive to the throne of Austria-Hungary, and his wife leave the Senate House of Sarajevo shortly before his assassination on June 28, 1914. UPI

Hungary and Serbia. The Austro-Hungarian government took the view that the assassination was the work of the Greater Serbian movement, and that the movement must be suppressed by an Austrian military expedition into Serbia. Otherwise the movement would become powerful enough, particularly if aided by similar movements, to cause the disruption of the Austro-Hungarian Empire. On July 23 Austria-Hungary sent an ultimatum to Serbia submitting ten specific demands, most of which had to do with the suppression, with Austrian help, of anti-Austrian propaganda in Serbia. Urged by both Great Britain and Russia, Serbia on July 25 accepted all but two of the demands; but Austria declared the Serbian reply to be unsatisfactory. The Russians then attempted to persuade Austria to modify the terms of the ultimatum, declaring that if Austria marched on Serbia, Russia would mobilize against Austria. A proposal, on July 26, by the British foreign minister Sir Edward Grey, Viscount Grey of Fallodon, that a conference of Great Britain, France, Germany, and Italy settle the Austro-Serbian dispute, was rejected by Germany. On July 28 Austria declared war against Serbia, either because it felt Russia would not actually fight for Serbia, or because it was prepared to risk a general European war in order to put an end to the Greater Serbia movement. Russia responded by partially mobi-

lizing against Austria; Germany warned Russia that continued mobilization would entail war with Germany. Germany also had Austria agree to discuss with Russia possible modification of the ultimatum to Serbia, but Germany insisted that Russia immediately demobilize. Russia declined to do so, and on Aug. 1 Germany declared war on Russia.

The French began to mobilize on the same day; on Aug. 2 German troops traversed Luxembourg and on Aug. 3 Germany declared war on France. On Aug. 2 the German government informed the government of Belgium of its intention to march on France through Belgium in order, as it claimed, to forestall an attack on Germany by French troops marching through Belgium. The Belgian government refused to permit the passage of German troops and called on the signatories of the Treaty of 1839, which guaranteed the neutrality of Belgium in case of a conflict in which Great Britain, France, and Germany were involved, to observe their guarantee. Great Britain, one of the signatories, on Aug. 4 sent an ultimatum to Germany demanding that Belgian neutrality be respected and, when Germany refused, declared war on that

country on the same day. Italy remained neutral until May 23, 1915, when, to satisfy its claims against Austria, it broke with the Triple Alliance and declared war on Austria-Hungary. In September, 1914, Allied unity was made stronger by the Pact of London, signed by France, Great Britain, and Russia. As the war progressed, other countries, including Turkey, Japan, the U.S., and other nations of the Western Hemisphere were

the war on the side of the Allies in May, 1915; and, after Bulgaria entered the war on the side of the Central Powers in October, 1915, a front on the Greek frontier north of Salonika. THE WESTERN FRONT. The German plan of campaign at the outset of the war was to defeat France quickly in the West while a small part of the German army and the entire Austro-Hungarian army held in check an expected Russian

"All the News That's Fit to Print."

The New York Times.

THE WEATHER
New York: partly clearing, cooler.
Thursday, August 6.
High 70, low 50, wind S.W.
Other cities: see page 2.

VOL. LXXII, NO. 1847. NEW YORK, WEDNESDAY, AUGUST 5, 1914—TWENTY PAGES. ONE CENT

ENGLAND DECLARES WAR ON GERMANY; BRITISH SHIP SUNK; FRENCH SHIPS DEFEAT GERMAN, BELGIUM ATTACKED; 17,000,000 MEN ENGAGED IN GREAT WAR OF EIGHT NATIONS; GREAT ENGLISH AND GERMAN NAVIES ABOUT TO GRAPPLE; RIVAL WARSHIPS OFF THIS PORT AS LUSITANIA SAILS

Kaiser Hurls Two Armies into Belgium After Declaring War.

LIEGE ATTACK REPULSED

German Guns Are Reported to Be Bombarding Both That City and Namur.

BELEAGERS RUSH TO ARMS

Parliament Assesses King's Appeal and Votes \$40,000,000 for National Defense.

FRENCH BORDER CLASHES

Swinging German Forces Crossing the Border Near Metz—In-Town and Mannheim.

RUSSIAN ATTACK MENEL

Over 17,000,000 Fighting Men of Eight Nations Now Engaged in the Colossal European War

SEAL ALLIANCE		Total	
	Men	Men	Men
Great Britain	2,500,000	2,500,000	2,500,000
France	3,500,000	3,500,000	3,500,000
Italy	3,000,000	3,000,000	3,000,000
Russia	1,500,000	1,500,000	1,500,000
Japan	1,000,000	1,000,000	1,000,000
United States	1,000,000	1,000,000	1,000,000
Other Allies	1,500,000	1,500,000	1,500,000
Total	17,000,000	17,000,000	17,000,000

These figures do not include the naval forces of the nations.

Commerce Ships Out; Will Pick Up British Cruisers as Escorts.

GERMAN WARSHIPS NEAR

Liner to Head for Newfoundland, Where Other English Ships Will Meet Her.

FRENCH CRUISERS OUTSIDE

Wireless Code Messages from Telegraph Station at Sayville Aid German Cruisers.

TO BE SENT TO WASHINGTON

The Division Reported Off Cape Cod in an Attempt to Cut French Cable.

OUR DESTROYERS PUT OUT

GERMAN FLEET SINKS A BRITISH MINE LAYER

Scuttled by Patrols in the Channel By the Kaiser's Warships

But Makes Its Escape

London Paper Reports One Going On, Says Wounded Are Landed.

BATTLE IN THE NORTH SEA?

London Paper Reports One Going On, Says Wounded Are Landed.

TWO GERMAN WARSHIPS TAKEN, 'ANOTHER SUNK'

French Fleet in the Mediterranean Reported to Have

State of War Exists, Says Britain, as Kaiser Rejects Ultimatum.

MUST DEFEND BELGIUM

King George Issues Call to Arms and Thanks the Colonies for Their Support.

ENVOY LEAVES BERLIN

British Foreign Office Makes Final Announcement One Hour Before Time Limit.

VOTE \$225,000,000 FUND

England Takes All Foreign Warships Building in Her Ports—Two from Turkey.

JAPAN TO AID ENGLAND

British Declaration of War With Germany, Following Rejection of Her Demand

LONDON, Aug. 4.—Great Britain declared war on Germany at 11 o'clock tonight.

The British Foreign Office has issued the following statement: "On the 4th of August, 1914, the British Government has received the German ultimatum to the effect that Belgium should be allowed to be used as a base for German troops to invade France."

BERLIN, Aug. 4.—(Reuters) After 11 o'clock the German Government has announced that it has received the British ultimatum to the effect that Belgium should be allowed to be used as a base for German troops to invade France."

England Calls All Unmarried Men From 18 to 38 To Serve King and Country in This Hour of Need

LONDON, Wednesday, Aug. 5.—A War Office announcement appears in the morning papers headed "Your Map and Country Need You."

The advertisement says that the object is to get the greatest war in the history of the world, and appeals to all unmarried men between the ages of 18 and 38 years to join the army immediately.

Newspaper headlines trace the tentacles of war as they entrap the globe.

THE NEW YORK TIMES

drawn into the conflict. Japan, which had made an alliance with Great Britain in 1902, declared war on Germany on Aug. 23, 1914. The U.S. declared war on Germany on April 6, 1917.

For dates on which all the nations involved in the war either issued declarations of war or broke diplomatic relations, see the list of *Nations Involved in World War I*, below. For details of the causes and events that brought the U.S. into the war, see UNITED STATES OF AMERICA, THE: *History*.

The Campaigns and Events of 1914-15. The military operations of World War I began on three major European fronts, the Western or Franco-Belgian; the Eastern or Russian; and the Southern or Serbian. In November, 1914, Turkey entered the war on the side of the Central Powers, and fighting also took place between Turkey and Russia in the Caucasus, and between Turkey and Great Britain at the Dardanelles and in Turkish-held Mesopotamia. Before the end of the year 1915 two more fronts had been established: the Austro-Italian, after Italy had entered

invasion in the East. The speedy defeat of France was to be accomplished by a strategic plan known as the "Schlieffen plan", which had been drawn up by Count Alfred von Schlieffen (1833-1913), German chief of staff from 1891 to 1907. The Schlieffen plan called for powerful German forces to sweep through Belgium, outflank the French by their rapid movement, then wheel about, surround, and destroy them. As executed with certain modifications in the fall of 1914, the plan at first seemed likely to succeed. The swift German incursion into Belgium at the beginning of August routed the Belgian army, which abandoned the strongholds of Liège and Namur and took safety in the fortress of Antwerp. The Germans, rushing onward, then defeated the French at Charleroi and the British Expeditionary Force of 90,000 men at Mons, causing the entire Allied line in Belgium to retreat. At the same time the Germans drove the French out of Lorraine, which they had briefly invaded, and back from the borders of Luxembourg. The British and French hastily fell back to the Marne R.; three German armies advanced steadily to the Marne and then crossed

*A recruiting station at
Scotland Yard, London, is
besieged by volunteers in
August, 1914.* UPI



the river. The fall of the French capital seemed so imminent that the French government moved to Bordeaux; but after the Germans had crossed the Marne, the French under General Joseph Jacques Césaire Joffre wheeled around Paris and attacked the First German army, commanded by General Alexander von Kluck (1846–1934), on the right of the three German armies moving on Paris.

In the First Battle of the Marne, which took place from Sept. 6 to 9, the French halted the advance of von Kluck's army, which had outdistanced the other two German armies and could not obtain their support. In addition, the German forces had been weakened on Aug. 25 when, believing the victory had already been won in the West, the German chief of staff, General Helmuth von Moltke, dispatched six corps to the Eastern front. The French pressure on the German right flank caused the retreat of von Kluck's army and then a general retreat of all the German forces to the Aisne R. The French advanced and, in an endeavor to force the Germans from the Aisne, engaged them in three battles: the Battle of the Aisne; a battle on the Somme R.; and the First Battle of Arras; but the Germans could not be dislodged, and even extended their line eastward to the Meuse north of Verdun. A race to the North Sea then took

place between the two belligerents, the objective being the Channel ports. The Germans were prevented from advancing to the French Channel ports chiefly by the flooding of the region of the Yser R. by the Belgians. The western part of the Allied line was held by the British who, in the race for the Channel, had advanced to Ypres, the southwest corner of Belgium. After taking Antwerp (Oct. 10), the Germans endeavored to break through the British positions in Belgium, but were checked in a series of engagements known collectively as the Battle of Flanders. In December the Allies attacked along the entire front, from Nieuport in the west to Verdun in the east, but failed to make any appreciable gains.

By the end of the year 1914 both sides had established lines extending about 500 mi. from Switzerland to the North Sea and had entrenched; these lines were destined to remain almost stationary for the next three years.

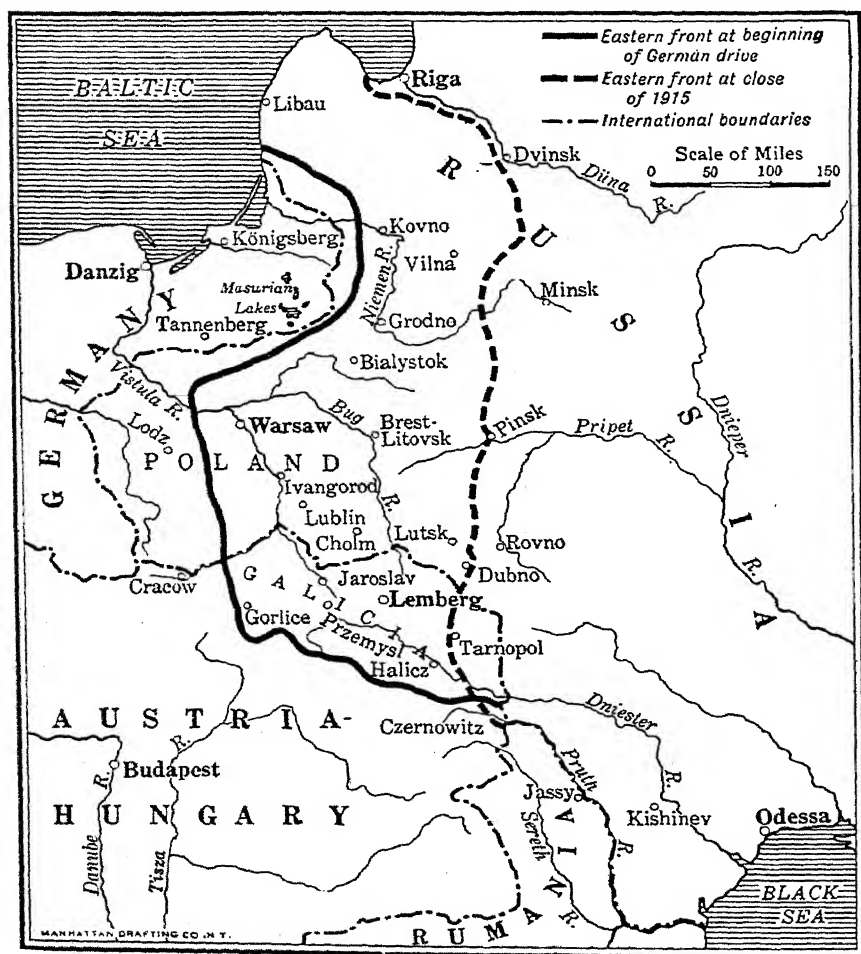
The Battle of Flanders marked the conclusion of the war of movement or fighting in the open in the West. From the end of 1914 until nearly the end of the war in 1918, the fighting consisted largely of trench warfare, in which each side lay siege to the other's system of trenches, consisting of numerous parallel lines of intercommunicating trenches protected by lines of

WORLD WAR I

barbed wire, and endeavored from time to time to break through the lines. In this type of fighting during 1915 in the West, the Allies were on the offensive; the Germans, who were engaged in a heavy offensive on the Eastern front (see below), made only a single attack in the West during the year. The principal attempts in 1915 to force a breakthrough included a British attack at Neuve Chapelle in March, which took only the German advance line. The Germans unsuccessfully attacked Ypres in April, using clouds of chlorine gas, the first time in history that gas was used in this manner on a large scale; see GAS WARFARE. A combined attack by the British and French along the front between Neuve Chapelle and Arras, in May and June, advanced troops $2\frac{1}{2}$ mi. into the German trench system, but did not secure a breakthrough. Unsuccessful simultaneous attacks in September by the British and French were unable to take, respectively, the town of Lens and Vimy Ridge (see VIMY) overlooking the town. And a large-scale

French attack in September on a front of 15 mi. between Reims and the Argonne Forest, took the Germans' first line of trenches, but was stopped at the second. On the whole the lines that had been established in the West at the close of 1914 remained practically unchanged during 1915.

THE EASTERN FRONT. On the Eastern front, in accordance with the plans of the Allies, the Russians assumed the offensive at the very outbreak of the war. In August, 1914, two Russian armies advanced into East Prussia, and four Russian armies invaded the Austrian province of Galicia. In East Prussia a series of Russian victories against numerically inferior German forces had made the evacuation of that region by the Germans imminent, when a reinforced German army commanded by General Paul von Hindenburg decisively defeated the Russians in the Battle of Tannenberg, fought on Aug. 26–30, 1914. The four Russian armies invading Austria advanced steadily through Galicia; they took



The Eastern Front

From: *Europe Since 1914 in its World Setting*. F. Lee Bennis. Copyright 1954 8th Edition by Appleton-Century-Crofts. Reproduced by permission of the publisher, Educational Division, Meredith Corporation.



Russian prisoners captured by the Germans as a result of their victory in the Battle of Tannenberg in August, 1914.

Przemysl and Bukovina, and by the end of March, 1915, were in a position to move into Hungary. In April, however, a combined German and Austrian army drove the Russians back from the Carpathians. In May the Austro-German armies began a great offensive in central Poland, and by September, 1915, had driven the Russians out of Poland, Lithuania, and Courland, and had also taken possession of all the frontier fortresses of Russia. To meet this offensive the Russians withdrew their forces from Galicia. The Russian lines, when the German drive had ceased, lay behind the Dvina R. between Riga and Dvinsk, and then ran south to the Dneister R. Although the Central Powers did not force a decision on the Eastern front in 1914-15, the Russians lost so many men and such large quantities of supplies that they were subsequently unable to play any decisive role in the war. In addition to the Battle of Tannenberg, notable battles on this front during 1914-15 were the First Battle of the Masurian Lakes (Sept. 7-14, 1914), and the Second Battle of the Masurian Lakes (Feb. 7-21, 1915), both German victories.

THE WAR IN SERBIA. On the Serbian front considerable activity took place in 1914-15. In 1914 the Austrians undertook three invasions of Serbia, all of which were repulsed; the Serbs, however, made no attempt to invade Austria-Hungary. The front remained inactive until October, 1915. Early that month, in anticipation of Bulgarian

entrance into the war on the side of the Central Powers, and in order to aid Serbia, which would be the target of Bulgarian attack, British and French troops were landed at Salonika, the gateway into the Balkans, by arrangement with the neutral Greek government. After Bulgaria declared war on Serbia on Oct. 14, the Allied troops advanced into Serbia. The Bulgarian troops defeated Serbian forces in Serbia and also the British and French troops that had come up from Salonika. Also in anticipation of the Bulgarian declaration of war, on Oct. 6 a strong Austro-German drive, commanded by General August von Mackensen (1849-1945), was launched from Austria-Hungary into Serbia. By the end of 1915 the Central Powers had conquered all of Serbia and eliminated the Serbian army as a fighting force. The surviving Serbian troops took refuge in Montenegro, Albania, and the Greek island of Corfu, which the French occupied in January, 1916, in order to provide a place of safety for the routed Serbians. The British and French troops in Serbia retreated to Salonika, which they fortified and where they were held in readiness for later action.

THE TURKISH FRONT. Turkey entered the war on Oct. 29, 1914, when Turkish warships cooperated with German warships in a naval bombard-



Sir Douglas Haig directed the British forces in France for the duration of the war. UPI

ment of Russian Black Sea ports; Russia formally declared war on Turkey on Nov. 2, and Great Britain and France followed suit on Nov. 5. In December the Turks began an invasion of the Russian Caucasus region. The invasion was successful at its inception, but by August, 1915, the hold that Turkish forces had gained had been considerably reduced. Turkish pressure in the area, however, impelled the Russian government early in 1915 to demand a diversionary attack by Great Britain on Turkey. In response, in February, 1915, British naval forces under the command of General Sir Ian Standish Monteith Hamilton bombarded the Turkish forts at the Dardanelles; and between March and August, three landings of Allied troops took place on the Gallipoli Peninsula, one of British marines in March, one of British, Australian, and French troops in April, and one of several additional British divisions in August. The Allied purpose was to drive all Turkish forces from Gallipoli and take the Dardanelles; however, strong resistance by the Turkish troops, commanded by Mustafa Kemal, later known as Kemal Atatürk, and bad generalship on the part of the Allied command resulted in heavy losses and complete failure for the Allies; the Allied troops were withdrawn in December of 1915 and January of

1916; see GALLIPOLI AND DARDANELLES CAMPAIGN in the Mesopotamian Valley, in the meantime, British forces from India defeated the Turks in a number of battles during 1914–15, particularly in the Battle of Kut-al-Imara; but in the Battle of Ctesiphon, November, 1915, the Turks checked the advance of the British toward Baghdad and forced them to retreat to Kut-al-Imara. On Dec. 7 the Turks laid siege to this town.

THE ITALIAN FRONT. Italy declared war on Austria-Hungary on May 23, 1915. The chief military events on the Austro-Italian front in 1915 were four indecisive battles between Austro-Hungarian and Italian armies on the Isonzo R. (June 29–July 7, July 18–Aug. 10, Oct. 18–Nov. 3, and Nov. 10–Dec. 10). The purpose of the Italian attacks was to break through the Austrian lines and capture Trieste.

The Campaigns and Other Events of 1916 and Early 1917. The success of the Germans in 1915 in thrusting the Russians back from East Prussia, Galicia, and Poland enabled the Germans to transfer approximately half a million men from the Eastern to the Western front for an attempt to force a decision in the West during 1916.

THE WESTERN FRONT. The German plan, as worked out by Erich von Falkenhayn, chief of the general staff of the German army, was to attack the French fortress at Verdun in great strength in an effort to weaken the French irretrievably by causing the maximum possible number of casualties. The Allied plan for 1916, as laid out by commanders in chief Marshal Joffre of the French army and General (later Field Marshal) Sir Douglas Haig of the British, was to attempt to break through the German lines in the West by means of a powerful Anglo-French offensive during the summer in the region of the Somme R. The German plan was the first to come to fruition. In February German forces attacked Verdun. After bitter fighting the Germans took Fort Douaumont (Feb. 25), Fort Vaux (June 2), and the fortifications of Thiaumont (June 23), but did not succeed in capturing the town of Verdun. The casualties on each side approximated 350,000. Because of the severe losses the French were able to contribute to the Allied offensive on the Somme only sixteen divisions of the forty originally planned; the offensive, which began on July 1 and continued until the middle of November, consequently was largely in the hands of the British. They succeeded in winning about 125 sq.mi. of territory, but the drive did not bring about a breakthrough. The first Battle of the Somme marked the earliest use of the modern tank (q.v.), deployed by the British on Sept. 15 in an attack near Courcelette. From October

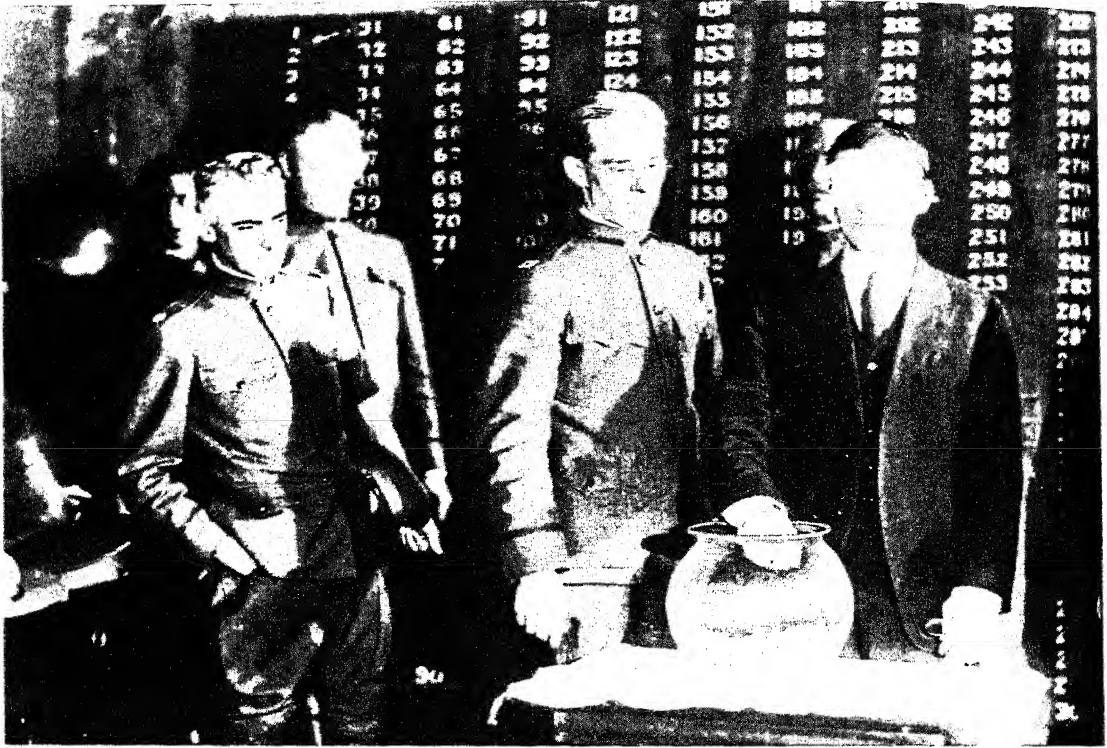
to December the French staged a counterattack at Verdun and succeeded in recapturing forts Douaumont and Vaux (Nov. 2), restoring the situation that had prevailed before February. In August, von Hindenburg replaced von Falkenhayn as German chief of staff with General Erich Friedrich Wilhelm Ludendorff. In December General Robert Georges Nivelle (1856–1924) succeeded Joffre as commander in chief of the French armies in the North and Northeast.

THE EASTERN FRONT. On the Eastern front in 1916 the Russians staged an offensive in the Lake Narocz region about 60 miles N.E. of Vilna. Their attack, designed to force the Germans to move troops from Verdun to the Lake Narocz region, was a complete failure. Not only did it fail to divert the Germans in any degree from their attack on Verdun, but the Russians lost more than 100,000 men. In June the Russians carried out a more successful offensive. In response to an Italian request for action to relieve the pressure of an Austrian offensive in the Trentino (see below), the Russians moved against the Austrians on a front extending from Pinsk south to Czernowitz. By September, when strong German reinforcements from the Western front stopped the Russian advance, the Russians had driven 40 mi. into the Austro-German position along the entire front and had taken about 500,000 prisoners. They did not succeed, however, in capturing either of their objectives, the cities of Kovel and Lemberg; and their losses of approximately 1,000,000 men left the army in a demoralized and discouraged state. The Russian drive had nonetheless given sufficient evidence of strength to play a strong part in inducing Rumania to enter the war on the side of the Allies (Aug. 27, 1916). After its entrance into the war, Rumania at once began an invasion of the Austro-Hungarian province of Transylvania (August–September), but Austro-German forces speedily drove the Rumanians out of that region and, in conjunction with Bulgarian and Turkish troops, invaded Rumania (November–December). By the middle of January, 1917, Rumania had been completely conquered, and the Central Powers had gained a valuable source of wheat and oil.

ITALY AND THE BALKANS. On the Italian front the year 1916 was marked by another inconclusive battle on the Isonzo R., the fifth of a series in that region; and by an Austrian offensive in the Trentino designed to break through the Italian lines and reach the rear of the Italian position on the Isonzo. The Austrians gained considerable territory in the Trentino, but lacked the strength to accomplish a breakthrough, and an

Italian counteroffensive (June–July) succeeded in regaining most of the captured terrain. From August to November four additional inconclusive battles took place on the Isonzo; the principal gain on either side was the capture of Gorizia by the Italians on Aug. 9. In the Balkans during 1916 the Allied Powers interfered in Greek affairs on the grounds that the Greek government under King Constantine I was, in spite of its declared neutrality, unduly favoring the Central Powers. Allied intervention brought about the establishment (Sept. 29) of a provisional Greek government under the statesman Eleutherios Venizelos, who had consistently favored the Allied cause. At Salonika the provisional government declared war on Germany and Bulgaria on Nov. 3. The government of King Constantine was still in power in Athens and large parts of Greece, and friction took place between that government and the Allies, who resorted to a naval blockade of Greece and other action in order to enforce their demands that the Greeks cease aiding the Central Powers. On Dec. 19 the British government officially recognized the provisional Greek government. Two periods of fighting took place in the Balkans during 1916. A Serbian army that had been brought to Salonika after having been reconstituted at Corfu, together with Russian and Italian troops, in August advanced against the Bulgarians and Germans on the Salonika front. After they had gained some initial successes, a strong counterattack thrust them back. Beginning in early October, Allied forces began a large-scale offensive in Macedonia. On Nov. 19 the Allied troops captured Monastir, and by the middle of December had reached Lake Okhrid (at present on the border between Albania and Yugoslavia).

THE TURKISH FRONT. The year 1916 was marked by considerable military activity in three parts of Turkey: Mesopotamia, Arabia, and Palestine. In the first-mentioned region, the besieged town of Kut-al-Imara fell to the Turks on April 29, 1916. In December of the year, strong British forces began a drive toward the town, which they recaptured in February of the following year. In Arabia in June, 1916, Hussein ibn-Ali, Grand Sherif of Mecca (1856–1931), continued the traditional conflict between Arabs and Turks by leading a revolt of the Hejaz against Turkish rule. Hussein had the encouragement and help of the British, who recognized him as king of the Hejaz in December, 1916. As a diversionary movement to aid the Arabian revolt, in November the British began an advance from Egypt, which they had strongly garrisoned since early in the war, into the Sinai Peninsula and Pales-



Newton D. Baker (blindfolded), U.S. Secretary of War, draws a number in the first large draft lottery in American history, in 1917.

U.S. Army

time, and by the early days of January, 1917, had taken several important fortified posts.

THE UNITED STATES ENTERS THE WAR. The year 1916 also witnessed a number of attempts on the part of President Woodrow Wilson of the U.S., at that time a neutral nation, to bring about negotiations between the belligerent groups of powers for a peace that would in his own words bring "peace without victory". As a result of his efforts, and particularly of the conferences held in Europe during the year by Wilson's confidential adviser, Colonel Edward Mandell House, with leading European statesmen, some progress was at first apparently made toward bringing an end to the war. In December the German government informed the U.S. that the Central Powers were prepared to undertake peace negotiations, but when the U.S. so informed the Allies, Great Britain rejected the German advances for two reasons: Germany had not laid down any specific terms for peace; and the military situation at the time (Rumania had just been conquered by the Central Powers) was so favorable to the Central Powers that no acceptable terms could reasonably be expected from them. Wilson continued his mediatory efforts,

calling on the belligerents to specify the terms on which they would make peace. He finally succeeded in eliciting concrete terms from each group, but they proved irreconcilable. Wilson still attempted to find some basis of agreement between the two belligerent groups until a change in German war policy in January, 1917, completely altered his point of view toward the war. In that month Germany announced that, beginning on Feb. 1, it would resort to unrestricted submarine warfare against the shipping of Great Britain and all shipping to Great Britain. German military and civil experts had calculated that such warfare would bring about the defeat of Great Britain in six months. Because the U.S. had already expressed its strong opposition to unrestricted submarine warfare, which, it claimed, violated its rights as a neutral, and had even threatened to break relations with Germany over the issue, Wilson dropped his peace-making efforts. On Feb. 3, the U.S. broke diplomatic relations with Germany and at Wilson's request a number of Latin American nations, including Peru, Bolivia, and Brazil, also did so. On April 6 the U.S. declared war on Germany.

The Campaigns and Other Events of 1917.

The year 1917 was marked on the Western front by two Allied attempts on a large scale to break the German lines.

THE WESTERN FRONT. The first Allied attempt took place near Arras between April 9 and May 21. While it was being planned by the British and the French high commands, the Germans withdrew from their original line along the Aisne to a new position, previously prepared somewhat to the north, and known as the Hindenburg Line, against which the Allies directed their attack. Their offensive included the Third Battle of Arras, in which the Canadian troops captured heavily fortified and stubbornly defended Vimy Ridge, and the British forces made an advance of 4 mi. in all; and a battle on the Aisne, and one in the Champagne district, both of which resulted in a slight French gain at a cost in casualties so great as to cause a mutiny among the troops. Because of the failure of his reckless at-

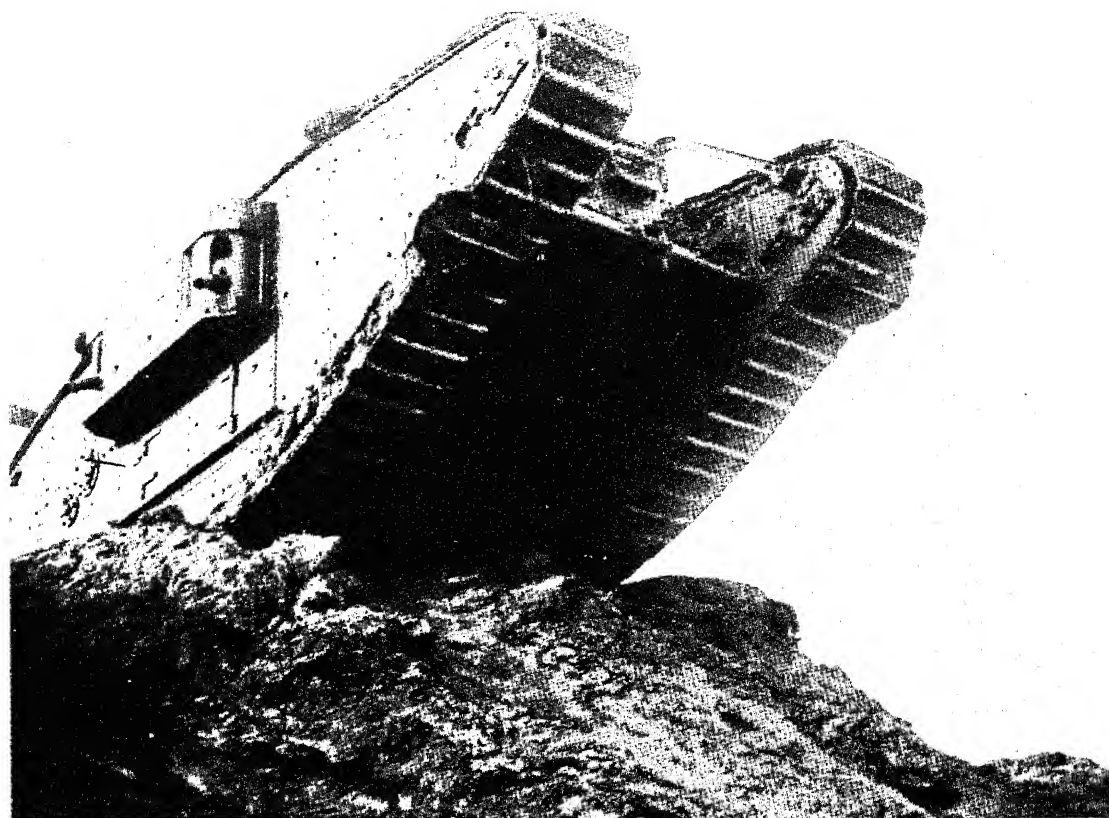
tack, on May 15 Nivelle was replaced by General (later Marshal) Henri Philippe Pétain; the new commander's policy was to remain on the defensive until American troops arrived in force from the U.S.

The second great Allied offensive took place in June, when the British under Haig made an attempt in Flanders to break through the right wing of the German position. A preliminary battle at Messines set the stage for the main attacks (July 31–Nov. 10) at Ypres. Desperate fighting, in which the British suffered approximately 400,000 casualties, did not result in a breakthrough.

Canadian machine gunners support the infantry during the assault on the German defenses at Vimy Ridge, France, in 1917.

Illustrated London News





A British tank goes into action against the Germans in 1917 at Cambrai. The battle marked the first large-scale use of tank warfare.

Illustrated London News

Other attacks of Allied forces on the Western front in 1917 included a battle at Verdun, in which the French succeeded in regaining an additional section of the area they had lost the previous year; and (Nov. 20–Dec. 3) the Battle of Cambrai, during which the British opened the attack with a raid by nearly 400 tanks. This was the first tank raid on such a scale in military history, and, but for lack of reserves, the British might have achieved a breakthrough. As it was, the British drove a 5-mi. salient into the German lines. German counterattacks, however, compelled the British to yield most of the newly won ground.

After the U.S. entered the war, in April, 1917, it moved rapidly to raise and transport overseas a strong military force, known as the American Expeditionary Force or A.E.F., under the command of General John Joseph Pershing. By June, 1917, more than 175,000 American troops were training in France, and one division was actually in the lines of the Allied sector near Belfort; by November, 1918, the strength of the A.E.F. was nearly 2,000,000. From the spring of 1918 Ameri-

can troops played an important part in the fighting (see below, *Campaigns and Other Events of 1918*).

SUBMARINE WARFARE. The year 1917 not only saw the intervention of the U.S. in the war, but also witnessed the failure of the German attempt to drive Great Britain to surrender through the destruction by submarine of the shipping, British and Allied, on which the nation depended for food and other supplies. At the outset the German submarine campaign seemed likely to succeed. Toward the end of 1916 German submarines were destroying monthly about 300,000 tons of British and Allied shipping in the North Atlantic; in April, 1917, the figure was 875,000 tons. Because the Germans had calculated that the destruction of 600,000 tons monthly for six consecutive months would be sufficient to force Great Britain to capitulate, they were doubly certain of victory after the month of April. Great Britain, however, roused itself to unprecedented efforts to fight the submarine menace. By the adoption of a system of convoying fleets of merchant vessels with warships, especially destroyers and submarine chasers, and by the use of hydroplanes for spotting submarines and depth bombs or charges (see **DEPTH CHARGE**) for

destroying them, as the summer advanced Great Britain rendered the German submarine campaign less and less effective. By the fall, although large numbers of Allied ships were still being sunk, the Germans were sustaining heavy losses in submarines. At the same time the Allied nations, especially the U.S., were building new shipping at a great rate. By the outset of 1918 they were turning out more new ships than the Germans were destroying, and the German effort to end the war by submarine warfare had clearly failed.

THE EASTERN FRONT. On the Eastern front the dominating influence on the fighting during 1917 was the outbreak in March of that year of the Russian popular uprising against the imperial government, which resulted in turn in the establishment of a provisional government and the abdication, in March, of Czar Nicholas II;

see **RUSSIAN REVOLUTION**. The provisional government continued the prosecution of the war. In July, under General Aleksei Alekseevich Brusilov, the Russians staged a moderately successful two-week drive on the Galician front, but then lost much of the territory they had gained. In September the Germans took Riga, defended by Russian forces under General Lavr Georgievich Kornilov, and in October occupied the greater part of Latvia and a number of Russian-held islands in the Baltic Sea. The Bolshevik party seized power through a military coup on Nov. 7. A cardinal point of Bolshevik policy was the withdrawal of Russia from the war, and on Nov. 20 the government that had just come into power offered the German government an armistice. On Dec. 15 an armistice was signed between the Russian and Austro-German negotiators, and fighting ceased on the Eastern front.

World War I commanders General John J. Pershing (left) of the U.S. and Marshal Ferdinand Foch of France confer on conduct of the war. UPI



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ITALY AND THE BALKANS. The year 1917 also witnessed an Allied disaster on the Italian front. During the first eight months of the year, despite deficiencies in manpower, artillery, and ammunition, the Italian forces under General Luigi Cadorna continued efforts to break through the Austrian lines on the Isonzo R. and to attain Trieste. The Italian drives of 1917, which resulted in the tenth and eleventh battles of the Isonzo, did not attain their objective. The latter part of the year (October-December) was marked by a determined Austro-German offensive carried on by nine Austrian and six newly arrived German divisions. Attacking on the upper Isonzo near the town of Caporetto, they succeeded in breaking the line of the Italians, who fell back in confusion from the Isonzo to positions on the Piave R. In the disastrous Caporetto campaign the Italian forces lost 300,000 men as prisoners alone and, the morale of the army being broken, approximately the same number as deserters. In November British and French troops arrived to reinforce the Italians on the Piave, and a new Italian commander in chief, General Armando Diaz (1861-1928), was appointed in place of General Cadorna.

On the Balkan front in 1917, after the Allied troops had fought several inconclusive engagements at Monastir, Lake Presba, and on the Vardar R., the Allies undertook the task of bringing about the abdication of the Greek King Constantine, claiming that his pro-German sympathies and his aid to the Central Powers made it impossible for the Allies to conduct successful operations in the Balkan region. In June the Allies began an invasion of Greece, and at the same time exerted diplomatic pressure on Constantine to abdicate. He did so on June 12; Venizelos became premier of the government formed under Alexander, the son of Constantine; and on June 27 the Greek government declared war on all four Central Powers.

THE TURKISH FRONT. In Palestine during 1917 the British made two unsuccessful attempts (March and April) to take the city of Gaza. Under a new commander, General (later Field Marshal) Sir Edmund Henry Hyman Allenby, the British broke through the Turkish lines at Beersheba (November), compelling the evacuation of Gaza; and on Dec. 8, Allenby's troops took Jerusalem. The year also witnessed the beginning of the brilliant leadership of British Colonel Thomas Edward Lawrence, known as "Lawrence of Arabia", in the Arab revolt against Turkey. Arab troops led by Lawrence took the Turkish-held port of 'Aqaba in July, and during the remainder of the year executed many forays

against the Turkish-held Hejaz railway. The year 1917 was also marked by British successes in Mesopotamia; they took Baghdad in March, and by September had advanced to Ramadi on the Euphrates R. and Tikrit on the Tigris.

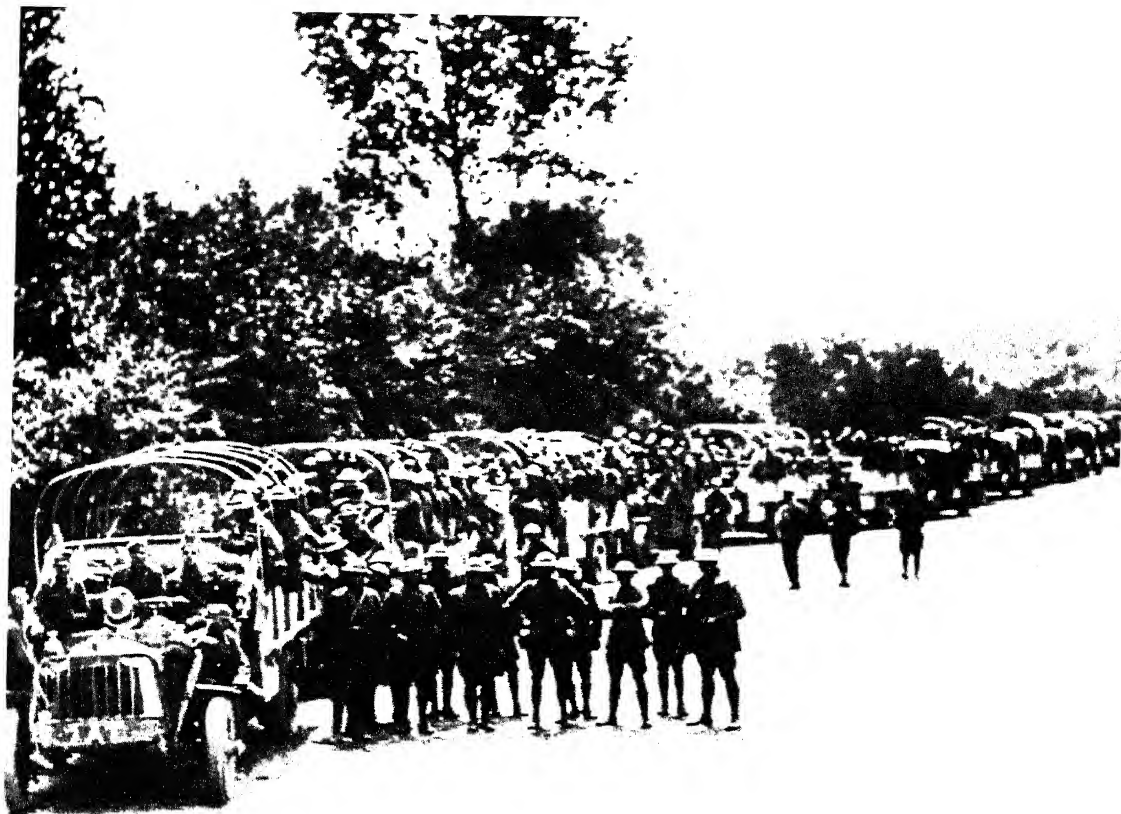
The Campaigns and Other Events of 1918.

The early part of 1918 was marked in eastern Europe by the definite withdrawal from the war of two of the Allied nations.

RUSSIA AND RUMANIA WITHDRAW. On March 3 Russia signed the Treaty of Brest Litovsk (see *BREST LITOVSK, TREATY OF*), which put an end to the war between that nation and the Central Powers on terms most favorable to the latter; and on May 7 Rumania made peace with the Central Powers, signing the Treaty of Bucharest, by the terms of which it ceded the Dobruja region to Bulgaria and the passes in the Carpathian Mountains to Austria-Hungary, and gave Germany a long-term lease on the Rumanian oil wells.

BULGARIA AND AUSTRIA-HUNGARY WITHDRAW. On the Balkan front, however, the result of the fighting of 1918 was disastrous to the Central Powers. In September a force of about 700,000 Allied troops, consisting of French, British, Greeks, Serbs, and Italians, began a large-scale offensive against the German, Austrian, and Bulgarian troops in Serbia. The Allied offensive was so successful that by the end of the month the Bulgarians were thoroughly beaten and concluded an armistice with the Allies. The German success in Rumania was nullified in November when, with the support of Allied troops who had advanced into Rumania after the Bulgarian capitulation, Rumania reentered the war on the Allied side. After the conclusion of the Bulgarian armistice the Serbian part of the Allied army continued to advance, occupying Belgrade on Nov. 1, while the Italian army invaded and occupied Albania.

On the Italian-Austro-Hungarian front, the Austrians, in June, attacked on the Piave and succeeded in crossing the river, only to be driven back with the loss of about 100,000 men. In October-November the Allies definitely gained the victory in Italy, routing the Austrians in an offensive that culminated in the Battle of Vittorio Veneto (Oct. 24-Nov. 4). The Allies completely shattered the Austrian army in this campaign; they took several hundred thousand prisoners and the remainder of the Austrian army fled into Austria. On Nov. 3 the Italians at last took Trieste, and on Nov. 5 they occupied Fiume. The shock of the defeat precipitated revolutionary events in Austria-Hungary. The Czechoslovaks had already set up a separate state; in October the South Slavs proclaimed their in-



dependence and in December set up an independent kingdom, later part of Yugoslavia. In November the Hungarians established an independent government. The Austro-Hungarian government at Vienna concluded an armistice with the Allies (Nov. 3), and a few days later (Nov. 12) the last Hapsburg emperor, Charles I, abdicated; on the following day the Austrian Republic was proclaimed.

TURKEY WITHDRAWS. During 1918 the Allies also brought the campaigning in Palestine to a successful conclusion. In September the British forces broke through the Turkish lines at Megiddo and routed the Turkish army and the German corps that was assisting it; after being joined by Arab forces under Lawrence, the British took Lebanon and Syria. In October they captured Damascus, Aleppo, and other key points, while French naval forces occupied Beirut, and the Turkish government asked for an armistice. An armistice was concluded on Oct. 30, and by its terms the Turks were obliged to demobilize, break relations with the Central Powers, and permit Allied warships to pass through the Dardanelles.

THE END OF THE WAR IN EUROPE. Despite the German victories over Russia and Rumania in 1917, at the outset of 1918 the Allies, principally through their spokesman Woodrow Wilson, for-

Men of a U.S. Marine Corps battalion en route to a rest camp after inflicting severe casualties on the Germans in the Battle of Belleau Wood, France, in June, 1918.

U.S. Signal Corps

mulated war aims drastically opposed to those already stated by the Central Powers; Wilson's peace policy was enunciated in an address to the U.S. Congress and comprised the fourteen points (q.v.), which were designed to bring about a just peace and were of considerable influence in inducing the Central Powers to cease hostilities later in the year. At the beginning of 1918 the Germans, realizing that victory by means of submarine warfare was impossible, and that they must force a decision on the Western front before American troops might take up positions there in force, planned for the spring of the year an all-out effort to break through the Allied lines and reach Paris. The opening drive of their powerful offensive, which began on March 21, was directed at the British front south of Arras. The drive hurled the British lines back 40 mi. before it was halted, on April 5, principally by hastily summoned French reserves. The fear of a German breakthrough aroused among the Allies by the German success in the first week of the offensive caused the Allies to appoint (March) General (later Marshal) Ferdinand Foch in charge of assuring

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coordination of Allied operations; in the following month he was made commander in chief of the Allied armies, French, Belgian, British, and American, in France. During April a second German thrust took Messines Ridge and Armentières from the British, and in June a powerful German surprise attack against the French on the Aisne drove a salient 40 mi. deep into the French position and enabled the Germans to reach a point of the Marne only 37 mi. from Paris. During this battle American troops first went into action in force; together with French troops, on June 4, the American Second Division halted the German advance at Château-Thierry. The Germans made additional gains of terrain in June, but by the middle of July the force of their offensive had largely been spent. In the Second Battle of the Marne, they succeeded in crossing the river, but once they were across their progress was halted by French and American troops. Sensing that the German drive had lost its power, on July 18 General Foch ordered a counterattack. The attack drove the Germans back over the Marne and marked the taking by the Allies of an initiative on the Western front that they retained to the end of the war.

Beginning with a British drive (Aug. 8-11) into

the German lines about Amiens, the Allies began the offensive that three months later resulted in German capitulation. During the last week of August and the first three days of September, British and French forces won the Second Battle of the Somme and the Fifth Battle of Arras, and drove the Germans back to the Hindenburg Line. A particularly strong German salient at Saint Mihiel (q.v.) was then reduced by American troops (Sept. 12-13), who took over 14,000 prisoners. In October and early November, the British moved toward Cambrai and the Americans advanced partly through the Argonne Forest. The latter thrust broke the German lines between Metz and Sedan. As a result of these offensives, Ludendorff requested his government to seek an armistice with the Allies. The German government initiated armistice talks (October) with the Allies, but they failed when President Wilson insisted on negotiating only with democratic governments. The British advance meanwhile made rapid progress in northern France and along the Belgian coast, and on Nov. 10 American and French troops reached Sedan. By the beginning of November the Hindenburg Line had been completely broken, and Germans were in rapid retreat on the entire Western front. The defeat of the German army had domestic political repercussions that were catastrophic to the established German government. The German fleet mutinied; an

Impromptu celebrations reflected the deep rejoicing of the peoples of the Allied nations at the end of World War I.

UPI



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uprising dethroned the king of Bavaria; and in November, Emperor William II abdicated and fled to the Netherlands. The German Republic was proclaimed on Nov. 9. An armistice commission had already been dispatched to negotiate with the Allies. At 5 A.M. on Nov. 11, at Compiègne, an armistice was signed between Germany and the Allies on terms laid down by the Allies; at 11 the same morning hostilities came to an end on the Western front.

Colonial Warfare. The forces in the German colonies of Africa and the Pacific, with the exception principally of those in German south-east Africa in late 1917 and in 1918, generally fought on the defensive. They were in some cases swiftly overcome, and in others gradually, but by the end of the war in 1918 practically all had capitulated to the Allies.

In 1914 the German colonies in Africa consisted of Togoland, the Cameroons (Ger. Kamerun), German Southwest Africa, and German East Africa. An Anglo-French force took possession of Togoland in August, 1914. In September of that year a British force invaded the Cameroons from Nigeria, and a French force invaded from French Equatorial Africa to the east and south of the Cameroons. After a number of campaigns in which the Germans several times defeated the Allied forces, German resistance was finally overcome in February, 1916. German Southwest Africa was conquered between September, 1914, and July, 1915, by troops from the British colony of the Union of South Africa. The most important of the German possessions in Africa, German East Africa, displayed the strongest resistance to the attacks of the Allies. Early attacks by British and troops from India (November, 1914) were repulsed by the Germans under General Paul von Lettow-Vorbeck (1870–1964). In November, 1915, British naval units gained control of Lake Tanganyika, and the following year the Allied forces (British, South Africans, and Portuguese) intended for the invasion of German East Africa were placed under the command of General Jan Christiaan Smuts. The year 1916 witnessed the capture by the Allies of the principal towns of German East Africa, including Tanga, Bagamoyo, Dar-es-Salaam, and Tabora, and the retreat of the troops of Lettow-Vorbeck into the southeast section of the colony. Late in 1917, however, the German forces took the offensive, invading Portuguese East Africa; and in November, 1918, they began an invasion of Rhodesia. When the armistice was signed in Europe in 1918, the Germans of German East Africa were still fighting, even though most of the colony was in the hands of the Al-

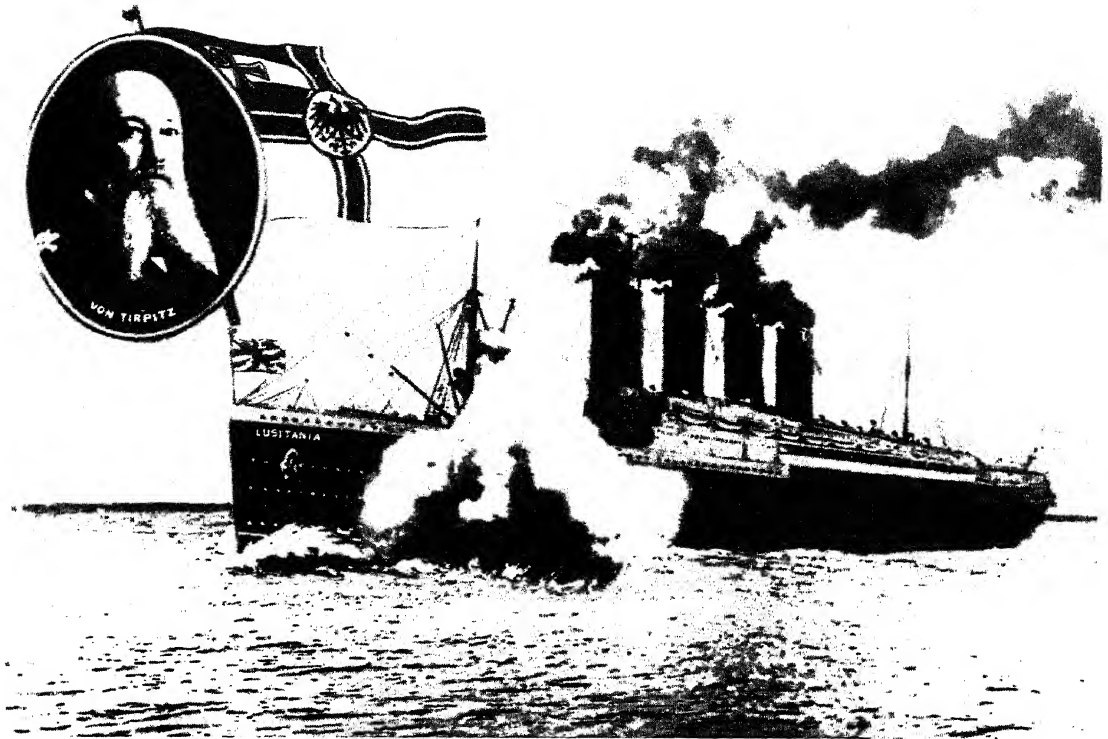
lies. Lettow-Vorbeck surrendered three days after the European armistice was declared.

For the disposition of the German colonies in Africa after World War I, see *AFRICA: History, Early 20th Century; Period Between Wars*.

In the Pacific, a force from New Zealand captured the German-held portions of Samoa in August, 1914; and in September, Australian forces occupied German possessions in the Bismarck Archipelago and New Guinea. Japanese forces took the fortress of Tsingtao, a German-held port in Shantung Province, China, in November, 1914; and between August and November of that year took possession of the German-held Marshall Islands, the Mariana Islands, the Palau group of islands, and the Carolines. After the war ended, Japan retained Tsingtao until 1922, and received a mandate over the Marshall Islands; a number of the Marianas, including Saipan; and over the Palau group and the Carolines.

The War at Sea. At the outset of war the main British fleet, the "Grand Fleet", consisted of twenty dreadnoughts and numerous other ships, including battle cruisers, cruisers, and destroyers; the Grand Fleet was based principally on Scapa Flow, in the Orkney Islands N. of Scotland. A second British fleet, consisting of older ships, was used to guard the English Channel. The German fleet, the "High Seas Fleet", consisting of thirteen dreadnoughts, was based on the North Sea ports of Germany. During 1914 no major naval engagements between the belligerents took place in the Atlantic. The British raided the German naval base at Helgoland Bight, an island off Germany in the North Sea, sinking three German ships. German submarines sunk a number of British naval units, including the superdreadnought *Audacious* (Oct. 27); and a daring attempt by German submarines to raid Scapa Flow caused the withdrawal of the British naval units based there to bases on the west coast of Scotland.

In the South Pacific, a squadron of German cruisers under command of Admiral Count Maximilian von Spee did considerable damage to installations at the French island of Papeete and British-held Fanning Island (September and October, 1914); defeated a British squadron off the headland of Coronel, Chile (Nov. 1); and on Dec. 8 was defeated with the loss of four out of its five ships in the Battle of Falkland Islands by a British squadron under Admiral Sir Frederick Charles Doveton Sturdee (1859–1925). During 1914 and the early part of 1915 a number of German cruisers did considerable damage to British shipping in the Indian Ocean and elsewhere



until captured or otherwise put out of commission.

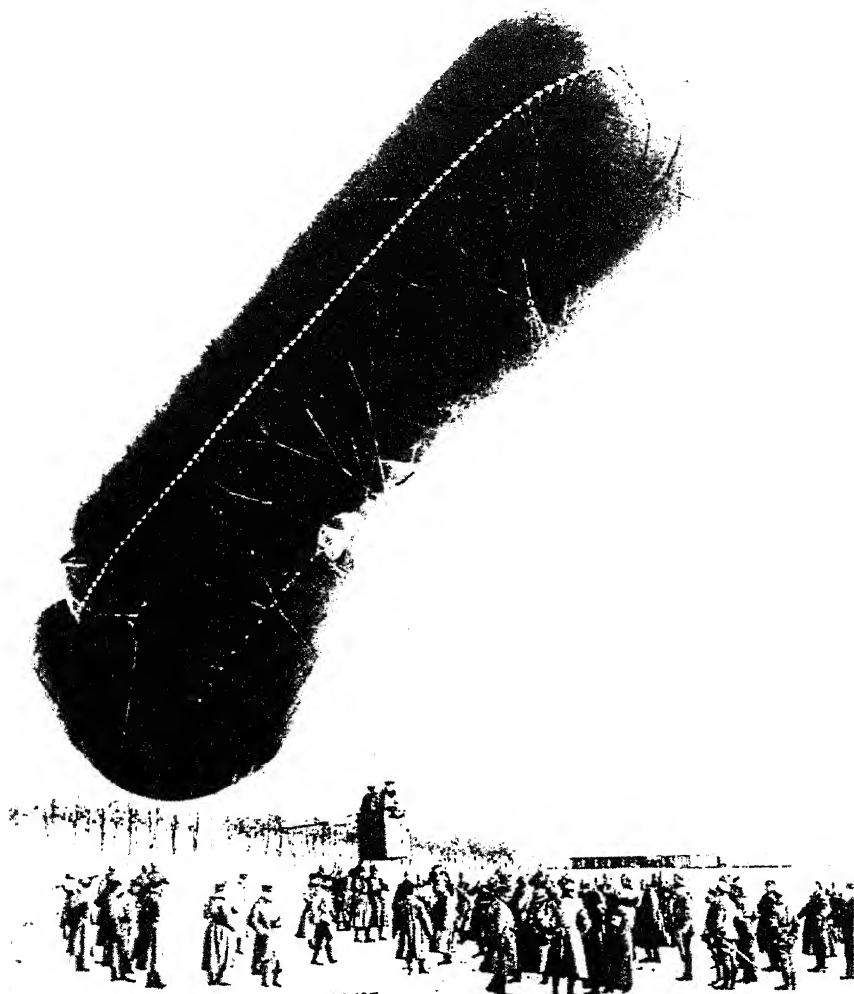
The year 1915 was notable in the naval warfare of World War I for the submarine blockade Germany instituted around Great Britain. The sinking by German submarine action of the British passenger liner *Lusitania* (q.v.) on May 7 caused the loss of many American lives, leading to a controversy between the U.S. and Germany that almost precipitated war between the two nations. The firm stand taken by the U.S. forced Germany to modify its method of submarine warfare to the satisfaction of the American government. In March, 1916, however, the German sinking in the English Channel by submarine of the French steamer *Sussex*, with the loss of American lives, led to another controversy between Germany and the U.S.; a virtual ultimatum on the part of the latter country caused Germany temporarily to cease its unrestricted submarine warfare.

The most important naval engagement of the war was the Battle of Jutland, which was waged on May 31 and June 1, 1916, between the British Grand Fleet and the German High Seas Fleet. Although the British loss in both tonnage of ships and human lives was greater than the losses sustained by the Germans, after once reaching its home ports again the German fleet did not ven-

The unarmed British passenger ship Lusitania is torpedoed by a German submarine. Admiral Alfred von Tirpitz (inset), secretary of state for the German imperial navy, advocated unrestricted submarine warfare. UPI

ture to give battle again during the war, and the British retained their supremacy at sea. Nevertheless, during the remainder of the war, German cruisers managed to run the blockade of Germany, which the British had established from the outset of the war. The Germans sank considerable amounts of Allied shipping in the North Atlantic and then returned to their bases. In 1917 the Germans again resorted to unrestricted submarine warfare, convinced that this method was the only one that would defeat Great Britain. The plan not only failed to force the capitulation of Great Britain, but also caused the U.S. to declare war against Germany. The attacks of German submarines on British convoys in the Atlantic and in the North Sea caused much loss of shipping (see below). As a result, in April of 1918 the British attempted to block up the German submarine bases at Ostend and Zeebrugge in Belgium; they succeeded in partially blocking up Zeebrugge by sinking three overage British cruisers in the harbor, but failed at Ostend. In October, however, British land forces, advancing through Belgium, took the two submarine bases and other Belgian ports.

A German war balloon is launched in 1917. The craft were primarily used for observing stationary battle fronts.



By the terms of the armistice the Germans surrendered to the Allies most of their fleet, consisting of 10 battleships, 17 cruisers, 50 torpedo boats, and more than 100 submarines. All of the fleet with the exception of the submarines was interned at Scapa Flow in November, 1918, with German captains and crews aboard. The Treaty of Versailles (1919), which ended the war, provided that all the interned ships become the permanent property of the Allies; that other warships still in German possession also be surrendered; and that the size of any future German navy be drastically limited. In reprisal against these terms, on June 21, 1919, the Germans scuttled their ships interned at Scapa Flow.

The total tonnage of Allied ships sunk by German submarines, surface craft, and mines totaled nearly 13,000,000; the largest tonnage sunk in any one year was about 6,000,000, in 1917.

Aircraft Operations. World War I provided a great stimulus to the production and military use of aircraft, including the airplane and airship (qq.v.) or dirigible balloon, and the captive balloon; *see also* BALLOON. Aircraft were used for two principal purposes: observation and bombing. For observation of stationary battle fronts extensive use was made by both belligerents of small captive balloons; for scouting at sea dirigible balloons were extensively used, and airplanes were used for scouting coastal waters. In connection with military operations on land, airplanes were used to observe the disposition of the enemy's troops and the state of his defenses and for bombing the enemy's lines or troops in action. A special feature of the war was the raids conducted by means of dirigibles or airplanes on important enemy centers far removed from the battle front.

The first German airplane raid on Paris took

place on Aug. 30, 1914; and the first German air raid on England was a raid on Dover on Dec. 21, 1914. During 1915 and 1916 the German type of dirigible known as the Zeppelin raided eastern England and London sixty times. The first German airplane raid on London took place on Nov. 28, 1916, and such raids were frequent during the remainder of the war. The object of the German raids on England was to bring about withdrawal of British planes from the Western front for the defense of the homeland; to handicap British industry; and to injure the morale of the civil population. The raids caused much loss of life and damage to property but accomplished little of military value.

From the middle of 1915 aerial combats between planes or groups of planes of the belligerents were common. The Germans had superiority in the air on the Western front from about October, 1915, to July, 1916, when the supremacy passed to the British. Allied supremacy gradually increased thereafter and with the entrance of the U.S. into the war became overwhelming. In April, 1918, the U.S. had three air squadrons

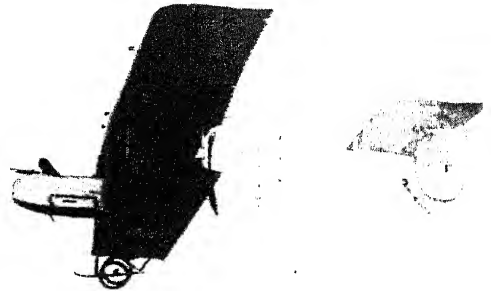
at the front; by November, 1918, it had forty-five squadrons comprising nearly 800 planes and over 1200 officers. The total personnel of the American air service increased from about 1200 at the outbreak of the war to nearly 200,000 at the end. Among the noted airplane fighters or "aces" were the American Edward Vernon Rickenbacker, the Canadian William Avery Bishop, and the German Baron Manfred von Richthofen.

See also AVIATION: World War I and After.

SUMMARY OF THE WAR

World War I began on July 28, 1914, with the declaration of war by Austria-Hungary on Serbia; and hostilities between the Allied and Central Powers continued until the signing of the Armistice on Nov. 11, 1918, a period of four years, three months, and fourteen days. The aggregate direct war costs of all the belligerents amounted to about \$186,000,000,000. Casualties in the land forces amounted to more than 37,000,000 (see the accompanying table of

A French biplane gives chase to a German Taube (Dove) airplane at the Western front in 1915. UPI



WORLD WAR I

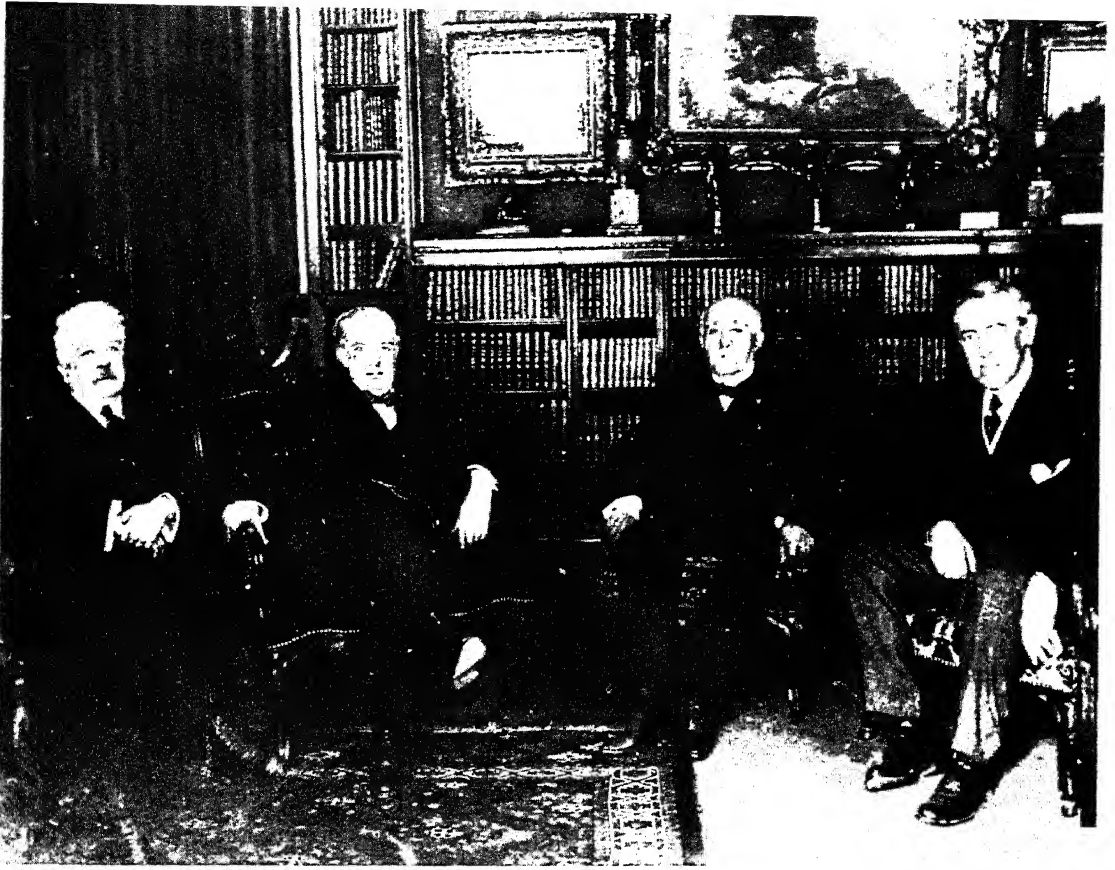
THE NATIONS INVOLVED IN WORLD WAR I

Austria-Hungary Declared war on Serbia Declared war on Russia Declared war on Belgium Declared war on Portugal	July 28, 1914 Aug. 6, 1914 Aug. 28, 1914 March 15, 1916	Honduras Declared war on Germany	July 19, 1915
Belgium Refused German ultimatum demanding permission for German troops to cross Belgium Invaded by Germany	Aug. 2, 1914 Aug. 3-4, 1914	Italy Declared war on Austria-Hungary Declared war on Turkey Declared war on Bulgaria Declared war on Germany	May 23, 1915 Aug. 21, 1915 Oct. 19, 1915 Aug. 28, 1915
Bolivia Severed relations with Germany	April 13, 1917	Japan Declared war on Germany Declared war on Austria-Hungary	Aug. 23, 1914 Aug. 25, 1914
Brazil Severed relations with Germany Declared war on Germany	April 11, 1917 Oct. 26, 1917	Liberia Declared war on Germany	Aug. 4, 1917
Bulgaria Declared war on Serbia Declared war on Rumania	Oct. 14, 1915 Sept. 1, 1916	Montenegro Declared war on Austria-Hungary Declared war on Germany Declared war on Bulgaria	Aug. 5, 1914 Aug. 8, 1914 Oct. 15, 1915
China Severed relations with Germany Declared war on Germany Declared war on Austria-Hungary	March 14, 1917 Aug. 14, 1917 Aug. 14, 1917	Nicaragua Declared war on Germany and Austria-Hungary	May 8, 1915
Costa Rica Severed relations with Germany Declared war on Germany	Sept. 21, 1917 May 23, 1918	Panama Declared war on Germany Declared war on Austria-Hungary	April 7, 1917 Dec. 10, 1917
Cuba Declared war on Germany	April 7, 1917	Peru Severed relations with Germany	Oct. 6, 1917
Ecuador Severed relations with Germany	Dec. 8, 1917	Portugal See Germany and Austria-Hungary in this table	
France Invaded by Germany Declared war on Austria-Hungary Declared war on Turkey Declared war on Bulgaria	Aug. 2, 1914 Aug. 12, 1914 Nov. 5, 1914 Oct. 16, 1915	Rumania Declared war on Austria-Hungary Capitulated to Central Powers by Treaty of Bucharest Reentered the war on the side of the Allies	Aug. 27, 1916 May 7, 1918 Nov. 10, 1918
Germany Declared war on Russia Declared war on France Declared war on Belgium Declared war on Portugal Declared war on Rumania	Aug. 1, 1914 Aug. 3, 1914 Aug. 4, 1914 March 9, 1916 Aug. 28, 1916	Russia Declared war on Turkey Declared war on Bulgaria	Nov. 2, 1914 Oct. 19, 1915
Great Britain Declared war on Germany Declared war on Austria-Hungary Declared war on Turkey Declared war on Bulgaria	Aug. 4, 1914 Aug. 12, 1914 Nov. 5, 1914 Oct. 15, 1915	San Marino Declared war on Austria-Hungary	June 3, 1915
Greece Declared war on Austria-Hungary, Bulgaria, Germany, and Turkey	June 27, 1917	Serbia Declared war on Germany Declared war on Turkey	Aug. 6, 1914 Nov. 2, 1914
Guatemala Declared war on Germany	April 23, 1918	Siam Declared war on Germany and Austria-Hungary	July 22, 1917
Haiti Declared war on Germany	July 12, 1918	Turkey Declared war on Rumania Severed relations with the United States	Aug. 30, 1916 April 23, 1917
		United States Declared war on Germany Declared war on Austria-Hungary	April 6, 1917 Dec. 7, 1917
		Uruguay Severed relations with Germany	Oct. 7, 1917

WORLD WAR I CASUALTIES

Country	Men Mobilized	Killed and Died*	Wounded	Prisoners and Missing	Total Casualties	Casualties in Percentage of Total Mobilized
Russia	12,000,000	1,700,000	4,950,000	2,500,000	9,150,000	76.3
France	8,410,000	1,357,800	4,266,000	537,000	6,160,800	73.3
British Empire	8,904,467	908,371	2,090,212	191,652	3,190,235	35.8
Italy	5,615,000	650,000	947,000	600,000	2,197,000	39.1
United States	4,355,000	126,000	234,300	4,500	350,300	8.0
Japan	800,000	300	207	3	1,210	0.2
Rumania	750,000	335,706	120,000	80,000	535,706	71.4
Serbia	707,343	45,000	133,148	152,958	331,106	46.8
Belgium	267,000	13,716	44,686	34,659	93,061	34.9
Greece	230,000	5,000	21,000	1,000	27,000	11.7
Portugal	100,000	7,222	13,751	12,318	33,291	33.3
Montenegro	50,000	3,000	10,000	7,000	20,000	40.0
Total, Allies	42,188,810	5,152,115	12,831,004	4,121,090	22,089,709	52.3
Germany	11,000,000	1,773,700	4,216,058	1,152,800	7,142,558	64.9
Austria-Hungary	7,800,000	1,200,000	3,620,000	2,200,000	7,020,000	90.0
Turkey	2,850,000	325,000	400,000	250,000	975,000	34.2
Bulgaria	1,200,000	87,500	152,390	27,029	266,919	22.2
Total, Central Powers	22,850,000	3,386,200	8,388,448	3,629,829	15,404,477	67.8
Grand Total	65,038,810	8,538,315	21,219,452	7,750,919	37,494,186	57.6

* Includes deaths from all causes, in army



Leaders of the major Allied nations at Paris in 1919, during the conference that worked out the terms of the Treaty of Versailles. Left to right: Prime Minister Vittorio Orlando of Italy, Prime Minister David Lloyd George of Great Britain, Premier Georges Clemenceau of France, and President Woodrow Wilson of the U.S.
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World War I Casualties); in addition, deaths among the civilian populations caused indirectly by the war approximated 10,000,000. Despite worldwide hopes that the settlements arrived at after the war would restore world peace on a permanent basis, World War I actually provided the basis for an even more devastating conflict. The defeated Central Powers declared their acceptance of President Wilson's fourteen points as the basis for the Armistice, and expected the Allies to utilize the principles of the fourteen points as the foundation for the peace treaties. On the whole, however, the Allies came to the conference at Versailles and to the subsequent peace conferences with the determination to exact from the Central Powers the entire cost of the war, and to distribute among themselves territories and possessions of the defeated nations according to formulas arrived at secretly during the years 1915 to 1917, before the entry of the U.S. into the war. President Wilson, in the peace negotiations, at first insisted that the Versailles Conference accept the full program laid out in the fourteen points; but finally, in order to secure the support of the Allies for the all-important fourteenth point, which called for the creation of an association of na-

tions, he abandoned his insistence on some of the other points. See LEAGUE OF NATIONS.

The peace treaties that emerged from the conferences at Versailles, Saint Germain, Trianon, Neuilly, and Sèvres were on the whole inadequately enforced by the victorious powers, leading to the resurgence of militarism and aggressive nationalism in Germany and to social disorder throughout much of Europe.

See separate articles for persons mentioned whose names are not followed by life dates. The military conflict is also described in separate articles on major battles; and for results of the war see separate articles on individual treaties; history sections of individual countries; and REPARATIONS.

WORLD WAR II, global conflict lasting from 1939 to 1945, and comprising in the totality of its manifold military engagements and related political, diplomatic, and economic struggles, the most stupendous complex of events in the history of mankind. Essentially, the war was a con-

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flit between two coalitions of states, designated the Axis powers (q.v.) and the Allies or United Nations; see UNITED NATIONS: *Origin of the United Nations*. The former comprised Germany, Italy, Japan, and their satellites; the Allies consisted of the United States, Great Britain, the Union of Soviet Socialist Republics, China, and their allies.

The war began with the invasion of Poland by Germany on Sept. 1, 1939, and was immediately broadened in scope by declarations of war against Germany by France and Great Britain. Italy entered the war in 1940 and in conjunction with Germany, extended the area of hostilities to Africa. Invasion of the Soviet Union by Germany on June 22, 1941, transformed the war into a general European struggle; and the attack by Japan on Hawaii on Dec. 7, 1941, followed at once by a declaration of war by Germany against the U.S., converted the European conflict into a global one. Before the war ended with the unconditional surrender of Germany on May 9, 1945, and of Japan on Sept. 2, 1945, a total of almost seventy nations were involved in the conflict in varying degree, ranging from severance of diplomatic relations with one or more belligerents to full participation in hostilities.

A table accompanying this article lists the nations involved in the war.

CAUSES OF THE WAR

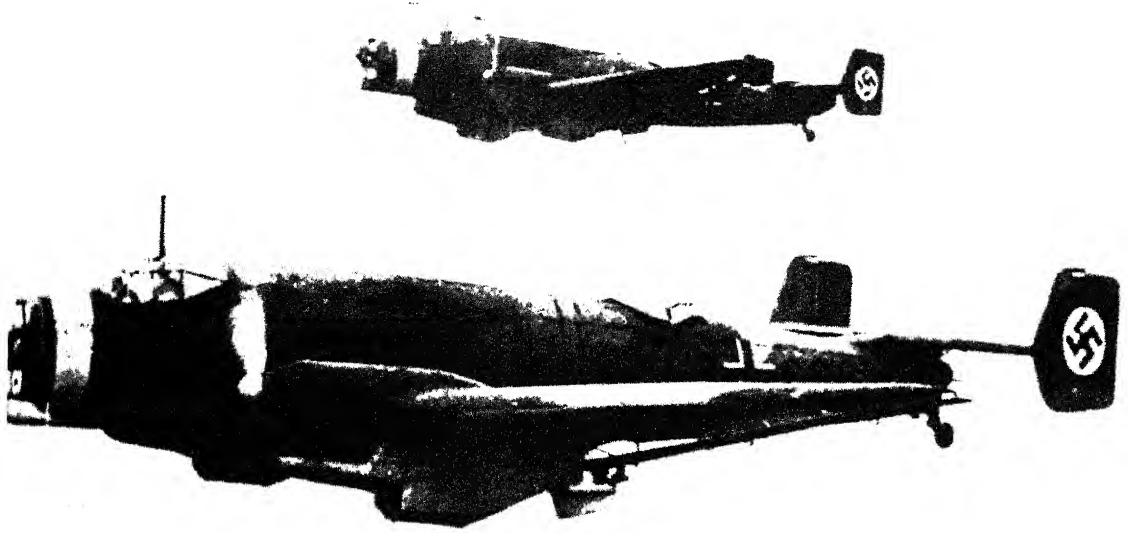
The causes of World War II are too numerous and complex to be reduced to a single generalization. Altogether, the more remote causes comprise all the principal factors and forces that shaped the development of modern capitalist society, divided on a world scale by the irreconcilable forces of imperialism and nationalism, and influenced by the development of totalitarianism (qq.v.) in its various forms. In the early 20th century, these factors culminated in the holocaust of World War I (q.v.). The developments following World War I that led to the outbreak of World War II are described in the section entitled *History* in the articles on Europe, Great Britain, France, Italy, Czechoslovakia, Austria, Greece, Japan, the U.S.S.R., the U.S., and other countries. The more immediate causes of World War II may be summarized as follows.

Effect of World War I. The end of World War I found Europe as a whole economically impoverished, politically divided by old and deep antagonisms, and facing the imminent possibility of social revolution, which had already occurred in the form of the Bolshevik revolution in November, 1917, in Russia; see RUSSIAN REVOLUTION. The precarious situation in Europe was further

threatened by the increasing pressure on the great colonial powers, Great Britain, France, and the Netherlands, of their subject peoples in Asia. The long-submerged aspirations of these peoples for national freedom had been quickened by the war and had been encouraged first by the declarations of U.S. President Woodrow Wilson in behalf of the principle of self-determination for all peoples, and then by the policy of the Soviet government of relinquishing czarist Russian colonial possessions and claims; see FOURTEEN POINTS.

The peace treaties that concluded the war provided for the establishment of the League of Nations (q.v.) as an instrument for the solution of disputes among nations. The capacity of the League for avoiding wars, however, was vitiated by the consequences of other provisions of the treaties, which, on the whole, failed to establish conditions conducive to the integration and recovery of European economy and to the political unity and social stability of the continent; see SAINT GERMAIN, TREATY OF; TRIANON, TREATY OF; VERSAILLES, TREATY OF. The principal authors of the peace, Premier Georges Clemenceau of France, Prime Minister David Lloyd George of Great Britain, and Premier Vittorio Emanuele Orlando of Italy, overcame or circumvented Wilson's proposals and reorganized Europe in accordance with the immediate interests of their governments. Through the system of mandates (q.v.) they obtained control of many former German colonial possessions in Africa and Asia, and they attempted to prevent the resurgence of Germany as a military power by reapportioning much of its territory, limiting the size and quality of its armed forces, and by imposing a system of reparations (q.v.) designed to indemnify the Allies for their losses in the war. As part of their plan to establish the hegemony of France on the European continent, they created under French control a group of central and east European buffer states between Germany and the Soviet Union; see LITTLE ENTENTE. In drawing the boundaries of the buffer states, the victors frequently disregarded ethnic considerations and divided various peoples among two or more nations, especially in Czechoslovakia and Poland. In the Far East the major powers encouraged the growing imperialist aspirations of Japan, rewarding that country for its nominal participation in the war against Germany with a mandate over the island possessions of Germany in the Pacific Ocean north of the Equator.

The effects of these arrangements have been the subject of considerable controversy among historians. Several, notably the British author



and statesman Sir Winston Leonard Spencer Churchill, have considered the territorial and armaments-limitations provisions of the treaties a reasonable attempt to prevent the reemergence of Germany as an aggressive power. These historians have found the principal causes of World War II in the failure of the former Allied powers to enforce these provisions even when the aggressive intent of the resurgent Germany became openly apparent. In Germany, however, many political factions decried the treaty arrangements, which they characterized as an attempt to place all blame for the war on Germany and to destroy the German nation. These attitudes were exploited among the German population in an eventually successful attempt to promote German rearmament and to discredit the postwar government of Germany, the so-called Weimar Republic, which had signed the treaties. Additional sources of conflict were the recurrent disputes among the peoples of the former empire of Austria-Hungary (q.v.) and other areas, which had been arbitrarily divided in an attempt to satisfy conflicting nationalistic interests without due regard to general political stability and harmony. The emergence of the new Soviet state, moreover, and its isolation by the great powers, created the premise for a po-

A squadron of German warplanes carrying bombs and equipped with machine guns flies in formation during practice maneuvers in 1938. Air power became a major factor during World War II.

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litical alliance of Soviet Russia and Germany against the Versailles system, which was consummated in the Rapallo Treaty in 1922.

The Depression and Social Upheaval. During the early 1920's Europe experienced an economic depression, and the course of European politics was determined largely by the Communist revolutions that occurred in a number of countries, most notably Germany and Hungary, threatening to subvert the social order of the entire continent. Communist attempts to repeat in other countries the Bolshevik success of 1917 in Russia failed, however, although the threat of Communist uprisings among the workers led to the rise of a new form of totalitarianism, known as fascism (q.v.), which began in Italy in 1922 with the establishment of a dictatorship under Benito Mussolini. A more extreme form of fascism, known as National Socialism (q.v.), began to emerge in Germany during the 1920's, under the leadership of Adolf Hitler. In the Far East, Great Britain strove to maintain the supremacy of its economic and political position by encouraging the growth of Japanese power to off-

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set the expanding interests and growing influence of the U.S. Relations among the great powers in the Far East were temporarily stabilized by the terms of the compact signed at the Washington Naval Conference in 1922; see **WASHINGTON CONFERENCE**.

As Europe achieved a measure of economic recovery in the latter part of the 1920's, the revolutionary tide ebbed, and the Soviet government, dominated by Joseph Stalin, became concerned primarily with the establishment of complete control over the Russian people, seeking to further its international interests largely through control of Communist parties throughout the world and through the development of an alliance with Germany.

All hope of political stability in Europe was shattered by the consequences of the worldwide economic depression that followed the crisis in the U.S. in 1929; see **BUSINESS CYCLE**. As the depression deepened during the early 1930's, resulting in widespread unemployment and acute distress, social relationships in Europe became strained. To large numbers of persons socialism (q.v.) seemed to be the solution to economic and social problems. In Germany, as belief in the capitalist system and democracy (q.v.) waned, a revolutionary situation began to develop in 1930, and raised the possibility that capitalism (q.v.) and the feeble Weimar Republic, which had striven to implement the Versailles Treaty, would be replaced with a social system and state on the order of the U.S.S.R. The possibility of a Communistic Germany raised, in turn, the further possibility that in conjunction with the power of the Soviet Union the Communist movement would constitute a revolutionary force that would overwhelm Europe.

Adolf Hitler. The growing political disorganization in Germany allowed Hitler and the National Socialists to gain control of the government, resulting in the establishment of the most violent and repressive dictatorship in history and in the reemergence of Germany as an aggressive military power. During the first two years of its existence, the Hitler regime was preoccupied with the liquidation of internal opposition, the consolidation of the National Socialist dictatorship, and the first stages of the transformation of German society into a totalitarian state. Then, in March, 1935, the German government, which had withdrawn from the League of Nations in October, 1933, formally denounced the provisions of the Versailles Treaty regarding the disarmament of Germany and proclaimed its intention to reintroduce conscription and increase the size of the armed

forces of the country. The League of Nations condemned this action, but no further efforts were undertaken against Germany by the great powers, who were unaware of or indifferent to the fact, proved by later events, that this step was the first in a series of planned moves comprising a sustained assault on the Versailles system. Hitler's purpose was eventually revealed as the establishment of Germany as the dominant nation in Europe and as the leading economic, political, and military power of the world.

In beginning his policy of conquest, Hitler was aided by the laxity of the great powers and by his exploitation, through propaganda and repression of political opponents, of the dissatisfaction of many Germans with the Versailles Treaty and other provisions of international law, which he flouted repeatedly. He was viewed in many quarters, moreover, as an acceptable bulwark against Communism and as the guiding force in the economic and military resurgence of Germany. He was also encouraged by the success of the Japanese, who invaded Manchuria in 1931, took Shanghai in 1932, and who, in 1933, resigned from the League of Nations despite its sanction of Japanese control over Manchuria. Disturbed by the Japanese conquest of Manchuria and alarmed by the menace inherent in Germany, the Soviet government, in 1934, reversed its foreign policy, entered the League of Nations, and approached other European states for a system of alliances to perpetuate the Versailles system against the menace of German power. This Soviet policy, known as collective security, met with little success at the time, because of the continued hostility of the great powers toward the Communist government.

The Axis. Mussolini, encouraged by the successes of the Japanese and Germans, undertook the conquest of Ethiopia in 1935. Germany took advantage of the political crisis resulting from that event by sending its armed forces in 1936 to reoccupy the Rhineland, virtually nullifying the Versailles Treaty and reducing the League of Nations to complete futility. Later that year the German and Italian governments established a close political relationship, known as the Rome-Berlin Axis, and then concluded a pact with Japan known as the Anti-Comintern Pact, proclaiming their joint intention to combat Communism. A momentous development in 1936 was the fascist rebellion in Spain, which resulted in civil war against the republic. The German and Italian governments intervened violently in the civil war on behalf of the Spanish fascists; the British and French governments, fearing that the success of the republican de-



Premier Benito Mussolini (left) of Italy and Chancellor Adolf Hitler of Germany joined their nations into the Rome-Berlin Axis in 1936.

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fenders would result in a Communistic dictatorship in Spain, restricted the amount of the supplies flowing to the loyalists from various parts of the world; and the Soviet government, hoping to defeat the fascists and establish a satellite state in Spain, made its assistance to the republic conditional on Soviet control of republican military and political policy. *See SPAIN: History: Spanish Civil War.*

In the Far East, the Japanese in 1937 took advantage of the preoccupation of the European powers with the Spanish civil war to extend their conquest of Manchuria southward. Also, during the second year of the Spanish Civil War, the policy of the U.S. government, which had extended diplomatic recognition to the Soviet Union in 1933, was defined by President Franklin Delano Roosevelt as one of unyielding hostility to the Axis. In a memorable speech delivered in Chicago in October, he called on the world to "quarantine" the aggressor states. His plea met with no effective response, and five months later, in March, 1938, Germany annexed Austria. In the following months, international tension mounted ominously as Germany put increasing pressure on Czechoslovakia for the cession of the region known as the Sudeten-

land, basing its claims on the large numbers of persons of German descent living in that area. The policy of appeasement of Germany by the great powers reached its climax in September, 1938, when Germany, Great Britain, France, and Italy signed a treaty at Munich, Germany, which became known as the Munich Pact (q.v.) and which provided for the partial dismemberment of Czechoslovakia.

In 1939 the international situation developed rapidly toward a final crisis. In March, Germany annihilated the Czech state, establishing a protectorate over the Czech provinces of Bohemia and Moravia, and creating the puppet state of Slovakia; Hungary seized the Czech territory of Carpathian Ruthenia. Neither aggressor was opposed by the great powers, but in April Great Britain and France signed a treaty of mutual assistance with Poland. In the same month Italy, also unopposed by the great powers, conquered Albania, and the Spanish Civil War ended in victory for the fascists; Spain signed the Anti-Comintern Pact. Tension increased again in the late spring and early summer as Germany put enor-

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mous pressure on Poland for surrender of the Polish Corridor, a strip of land separating the German province of East Prussia from the rest of Germany. The Polish government stood its ground. In the meantime, the Soviet government, engaged in an undeclared war with the Japanese in Manchuria and fearing attack in Europe, was pressing the British and French governments for an alliance against Germany, and was simultaneously negotiating with Hitler for an alliance, which, in the circumstances, could be directed only against the interests of Great Britain and France. Two agreements were concluded by the Soviet and German governments in August; one, a commercial accord, provided for increased trade between the two countries; the other, a pact of friendship and nonaggression, contained a secret clause providing for the partition of Poland by the two powers.

Roosevelt and the French and British governments appealed to Hitler to negotiate a peaceful solution of his demands on Poland. Fortified by the treaty with Stalin, however, Hitler adamantly demanded a free hand in dealing with Poland; the great powers refused. On Sept. 1, 1939, the German *Wehrmacht* ("defense force"), invaded Poland, unleashing the most destructive of all

wars. The British and French governments declared war on Germany on Sept. 3, but before they could come to the assistance of Poland that nation was conquered.

THE EUROPEAN WAR

World War II in Europe was waged on three major fronts: Eastern Europe and the U.S.S.R., beginning in Poland; North Africa and Italy, with additional campaigns in Greece and East Africa; and France, including several sustained German aerial assaults on Great Britain. Only in the last stages of the war were land armies engaged in Germany itself.

The Polish Campaign. The Polish campaign was one of the most violent and brutal in history and represented the first major use of the German offensive attacks known as *blitzkrieg* ("lightning war"). More than 1,000,000 German troops, operating with highly motorized armored units, or *panzer* divisions, under the overall command of General (later Marshal) Heinrich Alfred Walther von Brauchitsch, overwhelmed the greatly outnumbered and poorly equipped Polish forces. Further immense destruction was achieved by the German air force, the *Luftwaffe*, which destroyed virtually all Polish planes on the ground, disrupted Polish re-



A Czech woman weeps as she salutes German troops arriving in Cheb (Ger. Eger). The invasion of Czechoslovakia in March, 1939, was a major step in Hitler's decision to force a takeover of neighboring countries. UPI

serve, and reduced many large cities to rubble.

In accordance with the secret provisions of the Hitler-Stalin pact, the Soviet army crossed the Polish frontier on Sept. 17. Warsaw fell to the Germans on Sept. 27, and on the following day the German and Soviet conquerors signed a treaty effecting the partition of Poland. The conquest of Poland resulted in the systematic extermination by the National Socialists of millions of Poles and Jews, and the deportation by the German and Soviet governments of large numbers of Poles to Germany and Siberia, respectively, where they were used as slave laborers. See CONCENTRATION CAMP.

The "Sitzkrieg" in the West. In striking at Poland, Germany incurred the risk of having to fight, as in World War I, on two fronts simultaneously. The speedy conquest of Poland, however, temporarily closed the eastern front and enabled Germany to turn its undivided attention to the west. There, contrary to general expectations, hostilities did not begin immediately between France and Germany. The French forces, relying on such fortifications as the highly publicized and supposedly impregnable Maginot Line (see FORTIFICATION AND SIEGECRAFT), engaged in little offensive action against the apparently quiescent Germans, leading to a phase of the war that became known as the *sitzkrieg* ("sitting war"), or "phony war".

While the land front was inactive, the war was bitterly fought by the Allies and Germany on the high seas. The British and French navies, which were overwhelmingly superior in number of ships, total tonnage, and firepower, established Allied control over the entire seaborne commerce on the Atlantic Ocean and patrolled the North Sea, attempting to prevent the sorties of German submarines and surface ships from German ports and the Baltic Sea. German submarines hunted down and sank scores of Allied vessels. In the first important naval encounter of the war, the German pocket battleship *Admiral Graf Spee* was scuttled by its commander after being seriously damaged by three British cruisers off the coast of Uruguay in December, 1939.

The land front became active in the east, when, on Nov. 30, the U.S.S.R. launched an invasion of Finland, which ended in a Soviet victory in March, 1940; see RUSSO-FINNISH WAR.

The Norwegian Campaign. In April, 1940, the Germans, seeking to secure the Scandinavian peninsula and to establish air bases for an attack on Great Britain, launched an invasion of Norway. By the middle of May they had conquered most of the country. Narvik was taken by the Allies in April but was held for less than two

months; the retirement of Allied forces from that port on June 10, 1940, marked the end of the Norwegian campaign. The Allied defeat caused the fall of the British cabinet of Neville Chamberlain, who was succeeded by Winston Churchill. On the day that Churchill took office, May 10, 1940, Germany opened the assault on the Netherlands, Belgium, and France, known as the Battle of Western Europe.

The Battle of Western Europe. In the first phase of the attack, five German spearheads struck at the Netherlands. Among their objectives was the capture of Amsterdam, Rotterdam, and The Hague. The most powerful of these spearheads penetrated the gap between the Dutch and Belgian defenses, isolating most of the Dutch forces from their allies. An innovation of the attack was the use of parachute troops, who, after they were landed, succeeded, in collaboration with undercover agents and fifth columnists, in severing Dutch communication and supply lines and seizing all the airfields and principal cities of the Netherlands. The Luftwaffe swept all opposition out of the skies over the Netherlands and, in the greatest aerial bombardments ever made up to that time, razed large sections of Rotterdam and other cities with immense damage to the civilian population. After five days of valorous but futile and hopeless resistance, the Dutch surrendered.

In the meantime, in France, General Maxime Weygand, who had replaced General Maurice Gustave Gamelin as commander in chief, strove to organize an effective force to defend France against attack, particularly from German air power, which mercilessly strafed civilians and subjected the English Channel ports to continuous bombardment. Late in May, Weygand succeeded in putting together a force of thirty divisions with which he tried in vain to break through to Belgium, where the Allied forces had been withdrawing westward and were in a desperate situation. On May 28, the Belgian army, which had borne the brunt of the German attack, surrendered, exposing the entire northern flank of the remaining Allied forces in Belgium and compelling the Allies to fall back to the seacoast. The subsequent British evacuation from the seaport of Dunkirk (q.v.) was achieved with far fewer casualties than had been anticipated.

The British left behind them in France virtually all the heavy artillery and tanks they possessed; and they expended a considerable part of their small air force. Except for their navy, which could not operate effectively in the English Channel because of the supremacy of the Luftwaffe, the British had no means with which



Soldiers of the British Expeditionary Force leaving beleaguered Dunkirk form a human chain to wade to a rescue ship waiting to take them to England in June, 1940.

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to resist an invasion in force by sea and air. A German attack was expected, but the Germans instead turned south to conquer France.

On June 8, the Germans crossed the Aisne and the Somme rivers. Two days later, Italy, which had maintained large troop concentrations on the Franco-Italian border, forcing the French to immobilize on that front forces desperately needed in the north, declared war on France and Great Britain, and Italian forces invaded southern France. President Roosevelt denounced the Italian action, declaring, "The hand that held the dagger has struck it into the back of its neighbor".

Paris was declared an open city by the French government and was evacuated (June 10–13). Loss of the capital accelerated the disintegration of French morale. The Germans entered Paris on June 14. On the following day they captured

Verdun (q.v.), scene of the great victory won in World War I by Marshal Henri Philippe Pétain. The fall of the renowned fortress made untenable all French positions in the Maginot Line, which was abandoned. Premier Paul Reynaud (1878–1966) resigned on June 16 and was replaced by Pétain, then eighty-four years old; Pétain immediately asked the Germans for an armistice. To humiliate the beaten French, Hitler fixed the place of the armistice talks in the forest of Compiègne, where, in a railway car almost twenty-two years before, Marshal Ferdinand Foch had dictated to the Germans the armistice terms ending World War I. On June 22, in the same railway car used by Foch, the French accepted the harsh terms imposed by the Germans. An Italo-French armistice was signed by plenipotentiaries of the two countries on June 24 at the Villa Incisa near Rome. Germany there-

upon occupied the entire western coastal region of France, and, in total, an area comprising more than half of the territory of the country. Occupation of French territory by the Italians was limited to the small areas held by them at the time the Italo-French armistice was signed. The area left under French rule became known as unoccupied France and also, in consequence of the establishment of the government in the town of Vichy, as Vichy France. In London, the French National Committee, led by General Charles de Gaulle, denounced the armistices and declared its intention of continuing the war against the Axis. The Committee was active for the remainder of the war; its forces became known as the "Free French".

Prior to the French surrender, the British agreed to the capitulation on condition that all French naval vessels be placed under the British admiralty. The armistice terms, however, provided for the assembly in French ports and the demobilization and disarmament there of the French navy. When these terms were accepted by France, the British seized all French vessels in British and British-held ports. On July 3, 1940, a British fleet damaged several French vessels anchored in Oran, Algeria. Relations between Vichy and London became strained and never improved. Later, the Germans permitted the French government to maintain its fleet to meet further British attacks, and the French were able to ward off an attack on Dakar, on the west African coast, by a British-Free French naval expedition. On July 20, units of the British Mediterranean fleet engaged Italian war vessels off the island of Crete, and, pursuing them in a running fight, sank the cruiser *Bartolomeo Colleoni*, claimed by Mussolini to be the fastest warship in the world.

The Axis conquest of France had far-reaching consequences. It enabled the Germans to complete a huge network of air and submarine bases, extending in an arc along the western coasts of the European mainland from the Arctic Ocean to the Pyrenees Mts. So great was the toll of British shipping taken by the Axis that Great Britain was threatened with starvation. Spain was drawn closer to the Axis, and the Vichy government replaced the French republic with a totalitarian regime on the order of National Socialist Germany, inaugurating a policy of collaboration with the German conquerors. In Eastern Europe, Rumania, formerly part of the Little Entente, was partly dismembered as various parts of its territory were ceded to the Soviet Union, Bulgaria, and Hungary. Italy seized British Somaliland in Africa, and Japan intensified its

campaign of conquest in Asia, taking measures to isolate China. As a result of an agreement between Japan and Vichy France, all rail traffic from French Indochina to China was discontinued; and thousands of so-called inspectors, equipped with Japanese field packs, were sent into French Indochina, ostensibly to enforce the agreement, but actually to act as a fifth column. In an effort to appease the Japanese, Great Britain stopped shipping munitions and supplies to China over the Burma Road (q.v.).

The continued increase in Axis power caused concern in the U.S., which sought to prevent Germany from taking over Dutch and French colonial possessions in the New World by warning all European powers that it would not countenance the transfer to non-American countries of colonies owned by European nations in the Western Hemisphere. Congress enacted legislation providing for a "two-ocean" navy, intended to make the U.S. the dominant naval power in both the Atlantic and Pacific oceans. On Sept. 3 the Roosevelt administration made public the terms of an agreement with the British government, whereby in exchange for fifty old American destroyers, the British granted the U.S. ninety-nine-year leases of naval and air bases in British Guiana (now Guyana), a number of West Indian islands, and Newfoundland.

Also at this time the U.S. began an increasing mobilization for war, seeking to become, in Roosevelt's words, "the great arsenal of democracy". This mobilization, which eventually engaged virtually all the material and manpower resources of the U.S., was perhaps the decisive factor in the war. Through the conversion of civilian plants to wartime use, the exploitation of unparalleled technological ingenuity and managerial skill, and the opening of employment to thousands of new workers, the U.S. developed a productive potential that by 1943 had far exceeded the most optimistic estimates. The country was therefore enabled not only to supply its British and Soviet allies but to expand its own forces to an immense degree, while maintaining a standard of civilian life only marginally affected by rationing of critical materials. A momentous decision concomitant with this expansion of production was made by Roosevelt in 1941, when he authorized the development of the atomic bomb; see NUCLEAR ENERGY: *The Atomic Bomb*. While such developments were under way, however, the burden of resistance to Axis aggression fell, in Asia, on the Chinese, and, in Europe, on the British, notably in the protracted aerial engagements that came to be known as the Battle of Britain.



The dome of Saint Paul's Cathedral in London is engulfed by smoke during a German air raid in the blitz of 1940-41.

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The Battle of Britain. Immediately following the collapse of French resistance during the Battle of Western Europe, the Germans began to prepare for an invasion of the British Isles in the movement known as Operation Sea Lion. Landing barges and other craft were assembled at Dutch, Belgian, and French ports, and troops were concentrated along the European shore of the English Channel. The Luftwaffe began a systematic assault on the sea lanes leading to British ports, and in the British Isles, on shipping facilities, rail and other transport arteries, production centers, and military installations. Much of the bombing was deliberately centered on residential areas in an effort to weaken civilian morale. The air assault was opened by daily attacks made by about 100 bombers that bombed various places between John O' Groats at the northeastern extremity of Scotland and Land's End at the southwestern end of England. Shortly afterward the attacking force was doubled, and

subsequently it was increased to approximately 1000 planes. London was the principal target of these concentrated air raids and suffered extensive damage.

Under the indomitable leadership of Winston Churchill, the British underwent their ordeal unflinchingly. Immediately after Dunkirk they had begun preparations to resist an invasion and had worked at a feverish tempo to produce the necessary weapons. In these preparations they were aided greatly by large quantities of anti-aircraft guns and other equipment provided by the U.S., in accordance with the belief of the Roosevelt administration that the British Isles constituted a bastion that had to be held if the Nazi aggression were ever to be turned back. The British concentrated on the production of fighter planes and bombers; their hopes were pinned on the Royal Air Force (R.A.F.), which, although inferior in numbers to the Luftwaffe, enjoyed several advantages. British planes fought on interior lines of communication and were closer to their bases than the attacking German aircraft. Moreover, German airmen shot

Prime Minister Winston Churchill of Great Britain inspects a bombed area of London after a Luftwaffe assault in 1940.

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down over Britain were taken prisoner if they survived, whereas British airmen, who survived being shot down over their home territory, could return to the battle.

Late in August, 1940, the R.A.F. broke the brunt of the German air assault when, on Aug. 21, it destroyed about 200 out of a total of 1000 attacking planes, and repeated this achievement in the days immediately following. Thereafter the German offensive lost power. From the beginning of the air war, R.A.F. planes had systematically bombed the German barge and troop concentrations along the western European coasts, the lines of communication and supply leading to the ports from which the German invading force might be expected to embark, and German and Italian production centers. The R.A.F. ranged as far as Danzig (now Odánsk, Poland) on the Baltic Sea and Milan, Genoa, and Turin in Italy. German cities suffered serious punishment, production was affected and thousands of civilians were killed and wounded. On both sides, the air war was in essence a war of

extermination, which, however, hardened the resolve of the British and German peoples to continue the struggle and thus precluded an early end to hostilities.

In September, 1940, the Luftwaffe renewed the assault on Britain on a major scale. The number of attacking planes was fewer but they were concentrated on single targets. This phase of the offensive was opened by 500 aircraft that almost razed the city of Coventry, the principal automobile-production center of Great Britain. Subsequently, other cities, including Liverpool, Birmingham, Bristol, Sheffield, and Southampton, were similarly attacked. The climax of the air war came on Dec. 29, when London was subjected to a tremendous incendiary bombing. The R.A.F. retaliated with three incendiary attacks on Bremen that destroyed large sections of that city and killed many civilians. By the end of 1940, the German air attack had resulted in more than 23,000 British civilian deaths and the injury of more than 32,000. Early in 1941 the Germans virtually acknowledged a defeat, their first

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in the war, as the air assault slackened and indications multiplied that Hitler had abandoned his plans for invading the British Isles. The U.S., however, continued at an accelerated tempo its policy of arming and feeding Britain despite the Axis sea and air blockade of the British Isles. In March, 1941, the Roosevelt administration began the shipment of large amounts of food and military supplies under the Lend-Lease (q.v.) Act, signed by the President on March 11, 1941. A notable triumph was scored by the R.A.F. on Nov. 13, 1940, during the Battle of Britain, when torpedo planes sank or damaged approximately half the Italian fleet, which was anchored in the harbor at Taranto.

The Italo-Greek War, the Axis Balkan Campaign, and the Battle of Crete. During the Battle of Britain, important military operations were initiated by the Axis in southeastern Europe, and the war flared in North Africa. Both theaters of war were active simultaneously, but, in the interest of clarity they are described separately.

While Hitler was preoccupied with the air assault on the British Isles, his ally Mussolini created an unexpected and unwelcome diversion, when, on Oct. 28, 1940, he invaded Greece from Albania. The Italian dictator anticipated only weak resistance from the poorly equipped Greek army of 150,000 and counted on an easy triumph on the order of earlier German victories over Poland, Norway, the Low Countries, and France. The main Italian thrust was aimed at the Aegean port of Salonika. The fighting took place in mountainous terrain with which the Greeks were familiar, and although they fell back under the impact of the first Italian assault, they fought with great courage and determination. In ten days, aided by British troop reinforcements and the R.A.F., they slowed the Italian offensive to a standstill, and then launched a counterattack. In less than a month after the Italians began the war, they were driven out of Greece and were pursued into Albania by their intended victims. In the latter part of November, the Greeks captured Korçë, the principal Italian military base in Albania; and in the first part of December, they took Porto Edda (now Sarandë) and other Italian bases in Albania. British planes made systematic bombing attacks on cities in southern Italy and the British east Mediterranean fleet, aided by units of the small Greek navy, cleared the Strait of Otranto of Italian vessels.

For the Axis as a whole, the fiasco of Mussolini's bravura attempt to conquer Greece had serious consequences, obliging Hitler to con-

plate the possibility of a British entrenchment in Greece from which the Allies could conceivably threaten the Balkans. The necessity of securing that region, an indispensable source of food and industrial raw materials, which also gave strategic access to Germany by the Danube R. basin, undoubtedly played a part in Hitler's decision to abandon the idea of invading the British Isles and led him to undertake the Axis Balkan campaign.

German plans to eliminate Greek resistance and British opposition in the Balkans were facilitated by a number of political developments. On Nov. 20, 1940, Hungary joined the Axis and was followed three days later by Rumania. Bulgaria became a member of the Axis on March 1, 1941. The adherence to the Axis on March 25 of Yugoslavia provoked an uprising in that country on the following day; the government was overthrown, Peter II was proclaimed king, and the new regime declared its neutrality.






The Soviet government, alarmed by the swift extension of German influence in the Balkans, and anticipating a possible clash with the National Socialist conquerors, opened negotiations with the Japanese for a nonaggression pact in order to secure its position in the Far East. The Japanese, who had been defeated by the Soviet Union in several division-sized battles in 1938-39 in the undeclared war along the Manchurian-Soviet border, were also interested in securing their position in relation to the U.S.S.R. They were then perfecting plans for further aggression against southeastern Asia and for an attack on Hawaii, which materialized later in the year. A Soviet-Japanese nonaggression pact was signed at Moscow on April 13, 1941, one week after the Germans invaded Yugoslavia and Greece.

The Axis Balkan campaign was opened on April 6 by simultaneous attacks against Yugoslavia from Hungary and Bulgaria, and against Greek Thrace from Bulgaria. The Germans employed about 550,000 men, comprising task forces specially trained to fight on mountainous terrain, and operating in close coordination with the Luftwaffe; after the Germans effected a junction with the Italians in Albania, the Axis striking force was considerably augmented. The Allied defenders outnumbered the Germans by almost half a million men, but were badly situated. Most of the approximately 300,000 Greeks under arms were engaged in Albania, leaving to the Australians and New Zealanders, who comprised the bulk of the British force of about 100,000 men in Greece, the principal burden of resisting the German thrust into Thrace. Be-

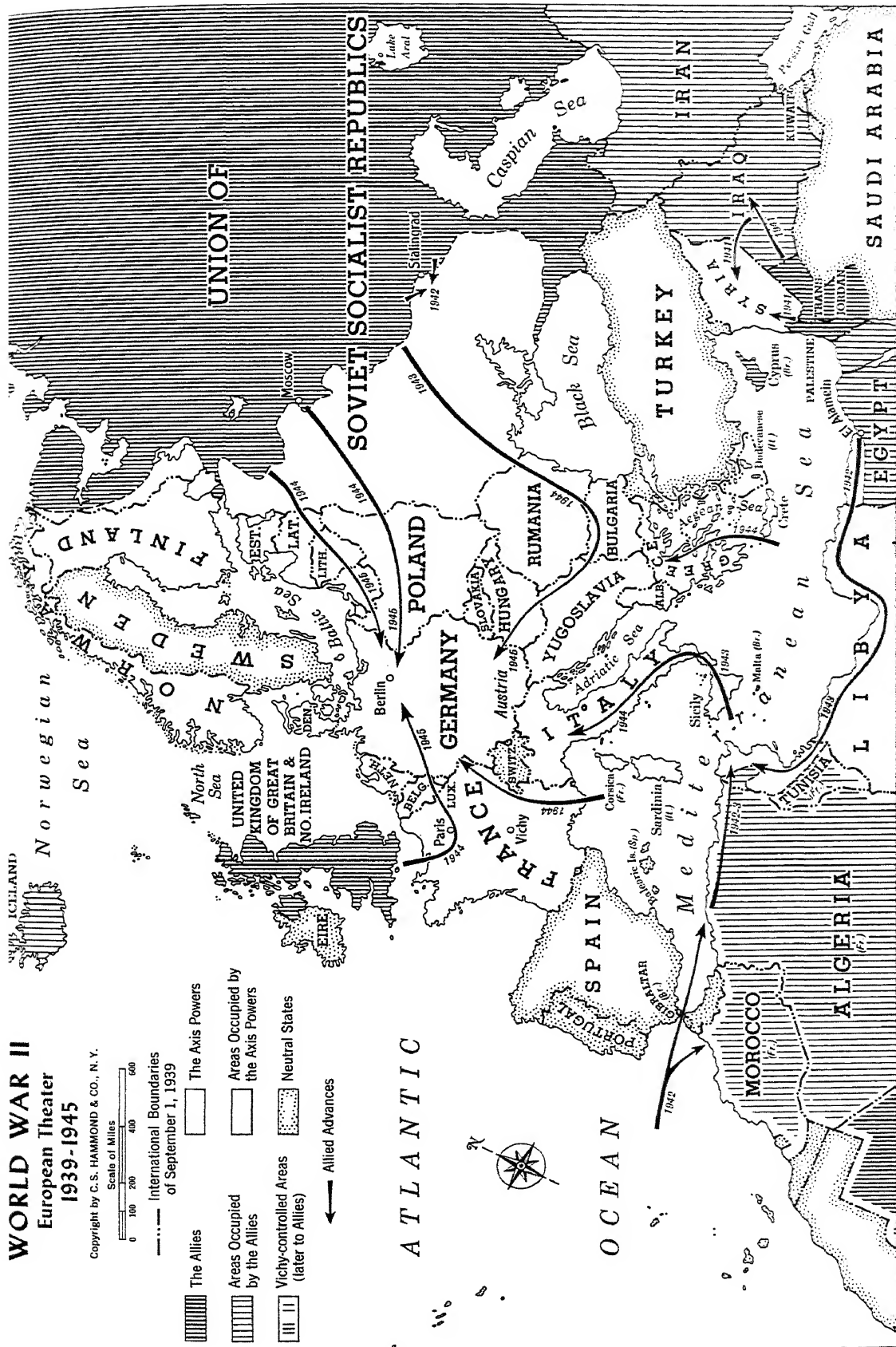
WORLD WAR II European Theater 1939-1945

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Scale of Miles
0 100 200 400 600
----- International Boundaries
of September 1, 1939

-  The Allies
-  Areas Occupied by the Allies
-  Areas Occupied by the Axis Powers
-  Vichy-controlled Areas (later to Allies)
-  Neutral States

← Allied Advances



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cause of political dissension, the Yugoslav army of approximately 500,000 men and 500 to 700 planes, half the entire defending ground and air force, was unable to offer effective opposition to the Wehrmacht. The defection of the Croats in the northern part of the country led to the creation of the Axis puppet state of Croatia and hastened the disintegration of Yugoslav resistance. Farther south German columns quickly cut off the Serbs from the Greeks, and other invading forces, which reached the Vardar R., advanced along the course of that stream toward Greece and the key port of Salonika. On April 12 the Germans and Italians effected a junction of their forces. Five days later the Yugoslavs capitulated; thereafter, armed resistance to the German conquerors was conducted in Yugoslavia by guerrilla forces.

While Yugoslavia was being overrun, the Germans were also making progress in Greece. Salonika was captured and Thrace was cut off from the rest of Greece during the first days of the campaign. Five days after the fighting began, on April 11, the British-Greek forces defending the Monastir Gap on the Yugoslav-Greek frontier were forced to retreat southward into Greece. On April 23, the Greeks signed an armistice with their Axis conquerors, and the British began the difficult task of evacuating their forces from Greece; completion of the withdrawal on May 1 marked the end of the Balkan campaign.

As a result of the conquest of the Balkans, the Axis acquired control of the Rumanian oil fields and of the Adriatic Sea and obtained a valuable shipping route from the Black Sea to the Adriatic. Because British naval power in the eastern Mediterranean threatened the security of these acquisitions, however, the Germans launched an attack on Crete almost immediately following their Balkan victory. Landing operations were begun by parachutists on May 20, immediately following intensive bombing and machine-gun attacks by the Luftwaffe. The capture of airfields and the improvisation of other landing fields made possible the arrival of transports carrying air infantrymen and motorcycle detachments. Within three days the Germans gained control of the western coast and hinterland and began air operations against offshore British naval units. Once again the superiority of air power over naval power that lacked adequate anti-aircraft weapons and air support was demonstrated, and British ships were withdrawn from Cretan waters on May 23.

As a result of its victory in Crete, the Axis made more secure the acquisitions of the Bal-



During the early phases of World War II, the Axis powers dominated the continent of Europe and part of northern Africa. Black area shows the furthestmost extent of their control.

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kan campaign, obtaining an important base for air operations against British naval installations in the eastern Mediterranean and against the British armies in Egypt and Libya. The Suez Canal became vulnerable to air attack, and the Axis seriously threatened the Middle East, where the principal stakes were the rich oil deposits of Iran and Iraq. In this new area of the war the sweeping Axis victories in Europe had resulted in a loss of British prestige and a rise of nationalist and anti-imperialist sentiment and activities. The Battle of Crete was accompanied and followed by an outbreak of military action in Iraq and Syria.

Fighting broke out in Iraq on May 2, one day after the end of the Balkan campaign, when Iraqi troops encircled the British-held airport at Habbaniya, 50 miles w. of the national capital, Baghdad, and opened fire on the British. The Germans bombed the Habbaniya airport and, in the northern part of the country, landed airborne troops that took the city of Mosul in the rich oil fields of that name; German officers began training Iraqi troops for operations against the British. On the whole, however, as a result of their preparations for the Battle of Crete, German commitments of men and equipment in Iraq were light, and the British, who enjoyed local air superiority, took the initiative.



By April, 1945, the Axis empire (black area) had crumbled. Most of the countries annexed by Hitler's armies had been liberated and half of Germany itself was conquered.

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Iraqi resistance collapsed after four weeks of fighting, and the Germans withdrew. The British secured the Mosul oil fields and immediately pressed their advantage, gaining control of Syria and Lebanon and consolidating their position in the Middle East to exert pressure on Turkey to keep it out of the Axis camp.

The War in Africa. While the Germans were engaged in the Battle of Britain the Italians were concentrating men and matériel in Libya, in preparation for an offensive to drive the British from Egypt, take Alexandria, and control the Suez Canal. If they could realize these objectives, they would compel the British to withdraw their fleet from the Mediterranean, which would then become an Axis sea. In September, 1940, the Italians, comprising about 250,000 men under Marshal Rodolfo Graziani, Marchese di Neghelli, struck at the British, consisting of about 100,000 men under General (later Field Marshal) Archibald Percival Wavell. In a few days they reached and took Sidi Barrani, about 70 miles e. of the border between Egypt and the Libyan Desert, halting to consolidate their gains and prepare for a further advance toward Alexandria. Although Egypt had thus been invaded by the Axis, the Egyptian government continued the policy of neutrality that it had adopted at the outbreak of the war. One reason for this

policy was the antipathy of Egypt toward Great Britain, which it regarded as an Imperialist oppressor of Arab and other colonial peoples; another reason was its expectation of an Axis victory.

Meanwhile the British navy continued to supply Malta and kept the Italian navy from gaining control of the Mediterranean. The efforts of the British Admiral Andrew Browne Cunningham confined the Italian fleet to its home port at Taranto and made the reinforcement of the Italian forces in North Africa extremely hazardous.

The British counterattacked on Dec. 9. On Dec. 11 they retook Sidi Barrani. Five days later they captured Salûm on the Libyan border; taking 40,000 prisoners. Their next objective was Bardia (El Bardi), in Libya, strongly fortified and held by 45,000 Italian troops. Following heavy air and naval bombardments, Australian shock troops opened the assault on Bardia on Jan. 3, 1941. Two days later that Italian citadel fell, and the entire Italian garrison was taken prisoner. Following up their advantage, the British launched a combined sea, air, and ground attack on Tobruk (q.v.), on the Mediterranean coast 70 miles w. of Bardia. Although Tobruk was strongly fortified, its outer defenses were pierced with relative ease and the city was taken within twenty-four hours on Jan. 22; about 25,000 Italians surrendered to the British. Moving westward along the coast, the British continued their victorious advance with the capture of Derna on Jan. 30 and then moved on to Benghazi, which fell to them on Feb. 9. More than 20,000 prisoners were taken by the British at Derna and Benghazi. From Benghazi small British units penetrated the Libyan coast for a distance of about 170 mi., reaching El Agheila. There they halted, and a temporary lull in hostilities followed. In this period of about two months the British took about 130,000 prisoners.

As in the Italo-Greek War, the debacle of Italian arms in North Africa imposed on Germany the necessity of extricating its Axis ally from the predicament into which it had fallen. The Germans therefore formed the *Afrika Korps* under General (later Field Marshal) Erwin Rommel (1891–1944), who became known as the "desert fox" because of his ability to elude British encirclements during the later stages of the African war. The Afrika Korps consisted of task forces specially trained to fight in a tropical climate, and included motorized infantry, motorcycle troops, small panzer forces, and tank and Luftwaffe units. This force and its equipment was conveyed, partly by air and partly by sea, to Tripoli, which was used by the Axis as its princi-

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pal base. To ensure the safety of the huge transport operation, the Luftwaffe maintained a steady bombardment of the British naval air bases on the central Mediterranean island of Malta, between Sicily and Libya. The total Axis force, much reduced from the original force of 250,000 Italians, and consisting mostly of Germans, numbered about 35,000 front-line troops and a smaller number of reserves. It outnumbered the British, whose ranks were depleted by the dispatch of 60,000 men to Greece after the resumption of fighting.

After grouping its forces, the Afrika Korps struck at El Agheila, which fell on March 24. Moving eastward, it avoided the coastal roads, which were open to attack by British naval units. On April 4 the British withdrew from Benghazi, and three days later, from Derna. Because the Axis was then scoring its first successes in the Balkan campaign, a gigantic pincers movement appeared to be closing on the entire British position in the Middle East. The danger increased on April 13, when Tobruk was surrounded by the Afrika Korps, which swept on to take first Bardia and then Salûm. For a time it seemed that Alexandria must inevitably fall. British resistance stiffened, however, as reinforcements began to arrive from East Africa (see accompanying chart), and the R.A.F. and the British Mediterranean fleet attacked Axis positions along the North African coast; Tripoli was subjected to intensive air bombardment. The Afrika Korps then advanced to a point about 25 miles e. of Salûm and halted to consolidate its position. By the end of April, when the Balkan campaign had ended in an Axis victory, the war in Africa had lapsed into inactivity, punctuated only by sporadic raids and reconnaissance actions.

The Fighting in East Africa. During the course of the Anglo-Italian war in North Africa, fighting between British and Italians also took place in East Africa. In the hostilities in that theater of operations, the principal strategic objective of the British was the security of the southern, or lower, half of the Red Sea and the Gulf of Aden, vital links in the lifeline of the British Empire from Great Britain to India and the Far East. British tactical objectives included the destruction of Italian armies; the capture of the Italian colonies of Eritrea, Ethiopia, and Italian Somaliland; the recapture of British Somaliland from the Italians, and the control of French Somaliland.

Operations began during the last week of January, 1941. The principal action during the first phase of the campaign developed from a British thrust into Eritrea from Kassala in the Anglo-

Egyptian Sudan. At the same time small British forces crossed into Ethiopia from a number of points in the Anglo-Egyptian Sudan and Kenya Colony; from the latter base, British patrol units penetrated Italian Somaliland. During April, the month of Axis victories in the Balkans and North Africa, the British continued their victorious progress in East Africa. Asmara and Massawa in Eritrea were taken, giving the British control of all of Eritrea. British forces took the Ethiopian capital, Addis Ababa, on April 6.

The victorious end of hostilities in East Africa was followed within a month by the British conquest of Iraq and Syria (see accompanying chart), and these successes considerably improved the military and political positions of the British. These victories, however, were won against the Italians; the heart of Axis power in Europe, the Wehrmacht and Luftwaffe, were still victorious everywhere they fought in strength, and Germany and Italy were in control of virtually all of the European mainland west of the Soviet Union. The British still had every reason to expect that in any further test of strength with the Germans they would again be defeated. Their outlook, despite steadily augmented material aid from the U.S., was gloomy. Suddenly, their prospects were immeasurably improved and the entire military and political situation in Europe was radically transformed by the German invasion of the Soviet Union on June 22, 1941.

The Russo-German War. Despite a number of conciliatory proposals made by Stalin in the winter of 1940-41, Hitler gave orders to prepare Operation Barbarossa, the code name for the invasion of the Soviet Union. The principal German objectives in Operation Barbarossa were the destruction of Soviet armed power and capture of the industrial establishments west of the Ural Mts., on which that power was based; occupation of the fertile grain-producing Ukraine; and capture of the oil-rich Caucasus region. To attain these objectives, the German operational plans called for three main drives; one through the Baltic states in coordination with a Finno-German thrust down the Karelian Isthmus to take Leningrad and its environs, a second through the White Russian S.S.R. to capture Moscow and the surrounding region, and the third through the Ukraine to Rostov and then into the Caucasus. Also included in the German plans were operations in the far north from Finland to capture the White Sea region of the U.S.S.R. Success of these plans would have given the Germans all of the Soviet Union in Europe west of an irregular line extending south-

east from Archangel on the White Sea to Astrakhan' on the Caspian Sea, and would have included the vital network of waterways including the Volga R., the principal traffic artery in the U.S.S.R. in Europe.

Complete control of this vast area, especially of the Ukraine and the Caucasus, would have given Germany enormous advantages. It would have immeasurably strengthened its war potential, assured it adequate food supplies, and yielded millions of slave laborers for German industries, thereby releasing German manpower for military purposes. If not sufficient to guarantee victory in the war as a whole, a successful campaign would at least, have enabled Germany to fight indefinitely. No less important would have been the strategic advantages. The conquest of Soviet Asia would have been a relatively easy operation, and then the Germans from the west and the Japanese from the east could have crushed China to extend their dominion from the Pacific to the Atlantic Ocean. From the Caucasus, Germany could next have descended on the Middle East to take and exploit the oil resources of Iran, Iraq, Saudi Arabia; and, from the Middle East, Soviet Asia, and conquered China, the Axis could have overwhelmed India. Thus, no campaign, with the possible exception of the Battle of Britain, was fraught with issues of such magnitude as was the invasion of the Soviet Union.

Operation Barbarossa began at 3 A.M. on June 22, 1941, 127 years to the day after the Grande Armée of the French emperor Napoleon I invaded Russia. Enormously exceeding Napoleon's effort in scope and number of men, Hitler's invasion was begun on a front of 2000 mi., extending from the Arctic Ocean to the Black Sea. The initial operations were directed personally by Hitler, who established field headquarters behind the front. Three army groups totaling approximately 3,000,000 men and the best equipment the Wehrmacht possessed, including about 15,000 tanks, were hurled at the Soviet defending forces; the Luftwaffe used four air fleets, composed of the finest combat aviation used in the war up to that time. After the fighting began, the Axis forces were augmented by a number of Italian divisions and by a Spanish force, called the Blue Division. Detachments of Hungarian, Slovakian, and Albanian troops also fought in the Axis armies.

German operational plans provided for a blitzkrieg, estimated to last no more than four months; the optimum expectation among German strategists was about three months. Hitler predicted a victory in six weeks, and many Al-

lied military experts concurred in his low estimate of the ability of the Soviet Union to defend itself. The Germans used tactics that had proved successful in previous lightning victories. Following large-scale air attacks, panzer units drove deep wedges into Soviet forces and created gaps in their dispositions, through which poured motorized infantry to fan out behind the Soviet army lines and surround and capture, or, with the aid of tanks and planes, destroy the Soviet troops trapped in these encirclements. The Germans scored immediate successes, took large numbers of prisoners, and captured great quantities of equipment.

As Hitler's veteran legions advanced with crushing force against the Soviet army, which was receiving its first baptism of fire in struggle with a powerful modern army, Stalin concentrated the direction of the entire Soviet war effort in the State Defense Committee, consisting of himself and four other members of the all-powerful Politburo of the Soviet Communist Party, including the minister of foreign affairs, Vyacheslav Mikhailovich Molotov, and the minister of internal affairs and head of the secret police or N.K.V.D., Lavrenti Pavlovich Berya. Like Hitler in the German camp, Stalin assumed personal direction of the military operations of the Soviet Union. Stavka, general headquarters of the Soviet army, was established in his office in the Kremlin. Stalin divided the front into three main sectors, placing Politburo member Marshal Klement Voroshilov in command of the northern or Leningrad front, minister of defense Marshal Semën Konstantinovich Timoshenko in command of the central or Moscow front, and deputy defense minister Marshal Semën Mikhailovich Budënniy in command of the southern front.

By July 11, when the Wehrmacht paused briefly to regroup its forces for further operations, it had reported the capture of 300,000 men and the destruction or capture of 7000 planes, 4000 tanks, and 3000 artillery pieces. Up to that time the Soviet army had not made a single major counterattack. The German drive was resumed on July 15 with rapid advances on all fronts. At the end of the first month of fighting the Axis had gained about 175,000 sq. mi. of Soviet territory. Throughout the campaign the Germans practiced inhuman barbarities on the Soviet population, uniting it in bitter hostility to the invaders.

During the latter part of July and in August, stiffened Soviet resistance slowed the German advance on the northern and central fronts; the greatest gain was made on the southern front.

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In the northern sector, the Germans captured Novgorod, between Leningrad and Moscow, on Aug. 26, and Tallinn, in Estonia, on Aug. 29. On the following day the Finns, allied with the Germans, occupied Viipuri (now Vyborg), on the Karelian Isthmus and advanced toward Leningrad. During this period the Leningrad-Murmansk and Leningrad-Moscow rail lines were cut by the Axis. On the central front Smolensk, about 225 miles s.w. of Moscow, which the Germans had reached on July 17, fell to them on Aug. 15. The Soviet army counterattacked at Smolensk. Disaster loomed on the southern front, where Kiev, third-largest city in the U.S.S.R., was besieged on Aug. 8 and Odessa was besieged on Aug. 13, and where the major forces of Budënný's command were driven back across the Dniester R. on Aug. 16. In accordance with the so-called scorched-earth policy, retreating Soviet forces dynamited the giant Dniepropetrovsk hydroelectric installations to prevent them from being used by the Germans. At the end of the second month of fighting, the Axis had gained an additional 125,000 sq.mi. of Soviet territory, most of it in the Ukraine, and the Germans were still advancing rapidly on the southern front. By the end of August, the Germans had captured Nikolayev on the Black Sea and were threatening to break through into the mineral-rich Donetsk basin and into the Crimea.

During July and August a Russo-British alliance was concluded. An agreement signed in Moscow on July 12 pledged the two governments "to render each other assistance and support of all kinds in the present war against Hitlerite Germany" and not to "negotiate nor conclude an armistice or treaty of peace except by mutual agreement". On Aug. 16, the British signed another agreement in Moscow, promising to supply arms and other war materials to the Soviet Union on a credit basis. Because the established routes of transportation were under Axis attack, the Russo-British allies decided on the occupation of Iran in order to secure a route of supply across Iran from the Persian Gulf to the Caucasus region of the U.S.S.R. In the southern part of Iran, the British, after seizing control of Bandar Shahpur on the Persian Gulf, southern terminus of the Trans-Iranian railroad, moved northward and captured the oil refineries at Abadan; in the northwest, Soviet troops occupied Tabriz. The U.S.S.R. was thus assured of a route for the transportation of badly needed supplies. A tripartite agreement was signed in Moscow on Oct. 1 by representatives of the U.S.S.R., Great Britain, and the U.S. It provided for the dispatch of American and British muni-

tions and equipment to the Soviet Union for the following nine months. On Oct. 30 the U.S. gave the U.S.S.R. a credit of \$1,000,000,000 for the purchase of war supplies.

In the period after Sept. 1, the German blitzkrieg in the Soviet Union reached its pinnacle and failed. On the northern front the Finns and Germans closed in on Leningrad; on Sept. 10 they began a systematic artillery and aerial bombardment of the city. Despite great hardship, the population and garrison refused either to surrender or evacuate Leningrad; occasionally the defenders made small local counterattacks. In October, Voroshilov was removed from the Soviet command of the northern front.

On the central front, Soviet counterattacks in September in the Smolensk and Bryansk sectors slowed the German advance on Moscow; but in October, following a speech by Hitler in which he promised an imminent victory in the war, the Wehrmacht launched a series of powerful attacks. Orel, about 200 miles s.w. of Moscow, fell to the Germans on Oct. 9. In rapid succession the Germans took a number of important cities on the approaches to Moscow, including Bryansk on the 13th, Vyaz'ma on the 14th, and Tula on the 16th. The fall of Tula, less than 100 miles s. of Moscow, created a desperate situation for the Soviet defenders. The German drive reached to within 30 mi. of the capital. At one point advance units were only 5 mi. from Moscow. Furious Soviet counterattacks developed at all the menaced points. Great losses of men and matériel were sustained by both sides. By the end of November, the German drive was stopped, and Soviet morale improved.

Meanwhile, a calamitous situation for the Soviet forces had developed on the southern front. German troops crossed the Dnieper at many points and took Chernigov, northeast of Kiev, on Sept. 13. Seven days later, the Germans occupied Kiev, taking 400,000 prisoners; on the same day they also captured Poltava, about 170 mi. to the southeast. Khar'kov was lost on Oct. 26. German penetration of the Crimean peninsula was achieved on Nov. 1 with the aid of parachute troops. The Germans overran the peninsula, taking the Crimean capital of Simferopol' on Nov. 3. The port and naval base of Sevastopol' held out until the end of the year, but Kerch', on the eastern extremity of the Crimean peninsula, fell on Nov. 18, placing the Germans within easy striking distance of the Caucasian shore of the Black Sea. Overwhelming disaster impended with the fall, on Nov. 23, of Rostov, at the head of the Sea of Azov, and the gateway to the Caucasus.

The Soviet army subsequently made a determined and successful counterattack, recapturing Rostov on Nov. 30 and Taganrog on Dec. 4. Two days later Stalin ordered a general counter-offensive on the entire front. Hitler, unable to take Leningrad and Moscow, his expectations of a blitzkrieg victory shattered, his troops beset by an unusually early and severe winter for which they were neither adequately clothed nor equipped, and unaware of his enemy's decision to take the initiative, overruled his generals. They advised a retreat to the west to shorten their lines in preparation for further advances in the spring. On Dec. 8 Hitler announced the suspension of further hostilities for the duration of the winter.

By that time, the Axis had suffered losses estimated by U.S. military observers at 1,300,000 dead and twice as many wounded and missing. Soviet losses, including civilian casualties, were undoubtedly much greater. When Hitler gave his order to suspend hostilities, the Axis held approximately 500,000 sq.mi. of Soviet territory, comprising about 40 percent of the entire population of the Soviet Union, 41 percent of the railway trackage, 38 percent of the grain production, 84 percent of the sugar, 65 percent of the coal, 68 percent of the pig iron, 58 percent of the steel, and 60 percent of the aluminum of the U.S.S.R. In short, the Soviet Union had suffered a catastrophe, but it had not been beaten, and it still possessed immense fighting capacities.

THE WAR DEVELOPS INTO A GLOBAL CONFLICT

As the German government decreed a halt in operations in Europe, its Axis partner on the other side of the world struck at the U.S. With the surprise attack on Dec. 7, 1941, on the American naval base at Pearl Harbor (q.v.) in the Hawaiian Islands, Japan transformed the European war into a global conflict involving all the great powers.

Background of the Japanese-American War.

After the passage of the Lend-Lease Act in early 1941, large amounts of munitions and supplies began to be carried to the British Isles from the U.S. in defiance of the German sea and air blockade. At the end of March the U.S. government seized 300,000 tons of Axis shipping in American ports. In April the U.S. concluded an agreement with the Danish ambassador to this country, which, in effect, placed Greenland under the protective custody of the U.S. for the duration of the war. On May 21 the U.S. suffered its first maritime casualty, when the merchantman *Robin Moor* was torpedoed by a Ger-

man submarine and sunk in the South Atlantic. Other sinkings followed. On June 14 Roosevelt issued an executive order freezing the American assets of the nationals of Germany, Italy, and the countries occupied by them. On June 16, to combat espionage by the Axis, the U.S. ordered the closing by July 10 and July 13 of all German and Italian consulates, respectively, in the U.S.

Following the German invasion of the Soviet Union, the Roosevelt administration extended the provisions of the Lend-Lease Act to the U.S.S.R., and American supplies began to flow across the North Atlantic to Murmansk and across the Pacific to Vladivostok. On July 7 American troops were landed in Iceland, in a move intended, as Roosevelt told the U.S. Congress, to prevent German occupation of Iceland and Greenland and to protect the North Atlantic sea route. The United States Navy was instructed to keep open the sea lanes between the U.S., Iceland, and all outlying American garrisons; it was instructed to shoot if attacked. By midsummer, large American naval and air forces were patrolling the Atlantic, and on Sept. 11 President Roosevelt, in a radio broadcast, warned the Axis that American warships and planes would fire at sight on Axis warships in waters vital to American defense. In August, Roosevelt met Churchill on a warship at sea, and from that dramatic conference issued the Atlantic Charter (q.v.), defining in general terms the principles underlying the association of the British and U.S. governments; see FOUR FREEDOMS. The U.S. destroyer *Kearny* was torpedoed and damaged by a German submarine off Iceland on October 17; thirteen days later the destroyer *Reuben James* was similarly torpedoed and sunk off Iceland. Attacks on American merchantmen continued. The President demanded of Congress modification of the Neutrality Act to permit the arming of American merchant vessels and to authorize them to enter belligerent ports; see NEUTRALITY. Congress complied by a small majority on Nov. 7.

Tense as was the situation in the Atlantic, a still graver crisis developed in 1941 in the Pacific, as a result of the determined drive by Japan for military domination and economic control over the peoples and resources of all eastern Asia and the rich islands of the western Pacific. As late as May 5, the British and U.S. governments hoped to conciliate Japan and keep it out of the war, and they authorized British and American oil companies operating in the Netherlands Indies to renew for another year their 1940 contract to deliver 1,800,000 tons of petroleum annually to Japan.

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Diplomacy, however, failed to prevent a steady increase in tension. On May 25 the Japanese in French Indochina seized \$10,000,000 worth of American-owned gasoline and other goods originally destined for China. Four days later, the U.S. suspended the export from the Philippines to Japan of raw materials needed by the Japanese war machine. Japanese occupation of French Indochina on July 23, 1941, was followed by the suspension by the U.S. of diplomatic negotiations then under way in Washington for an amicable solution of the differences between the Japanese and American governments, and the Roosevelt administration froze Japanese assets in the U.S. The British and Dominion governments and the Netherlands Indies thereupon also froze Japanese assets. The effect of these actions was to suspend virtually all of Japanese trade relations with those countries, and to impose economic sanctions that isolated Japan from sources of oil, tin, rubber, scrap iron, and other basic raw materials in which it was deficient and which were vital for the continued operation of its economy and war machine.

Japan therefore had to choose between the two alternatives implicit in its situation ever since it had become involved in the attempt to conquer China. One alternative was compliance with the frequently expressed American demands for its withdrawal from China and its pursuit of a policy of noninterference in the internal affairs of other countries. For Japan to have followed this course would have meant an end to its status as one of the major powers of the world, and, at least in the view of its government, would have resulted in its subordination to the U.S. The other alternative was war with the U.S. Considered solely on the basis of a comparison of the strength of the two countries, victory in a war with the U.S. was unlikely. When weighed, however, in the context of an anticipated Axis victory over the U.S.S.R. and, in consequence, a German-Japanese alliance that could bring its full power to bear against the U.S. from Europe and Asia, victory seemed to the Japanese almost certain.

The Japanese government elected the second course, war. After occupying French Indochina, it began the rapid conversion of Saigon and other strategically situated points into bases for attacks on Malaya and western Pacific islands. It also attempted to gain time to perfect its plans by resuming diplomatic negotiations with the U.S. for a solution of outstanding differences. An exchange of notes followed.

On Oct. 2 the U.S. requested Japan to clarify

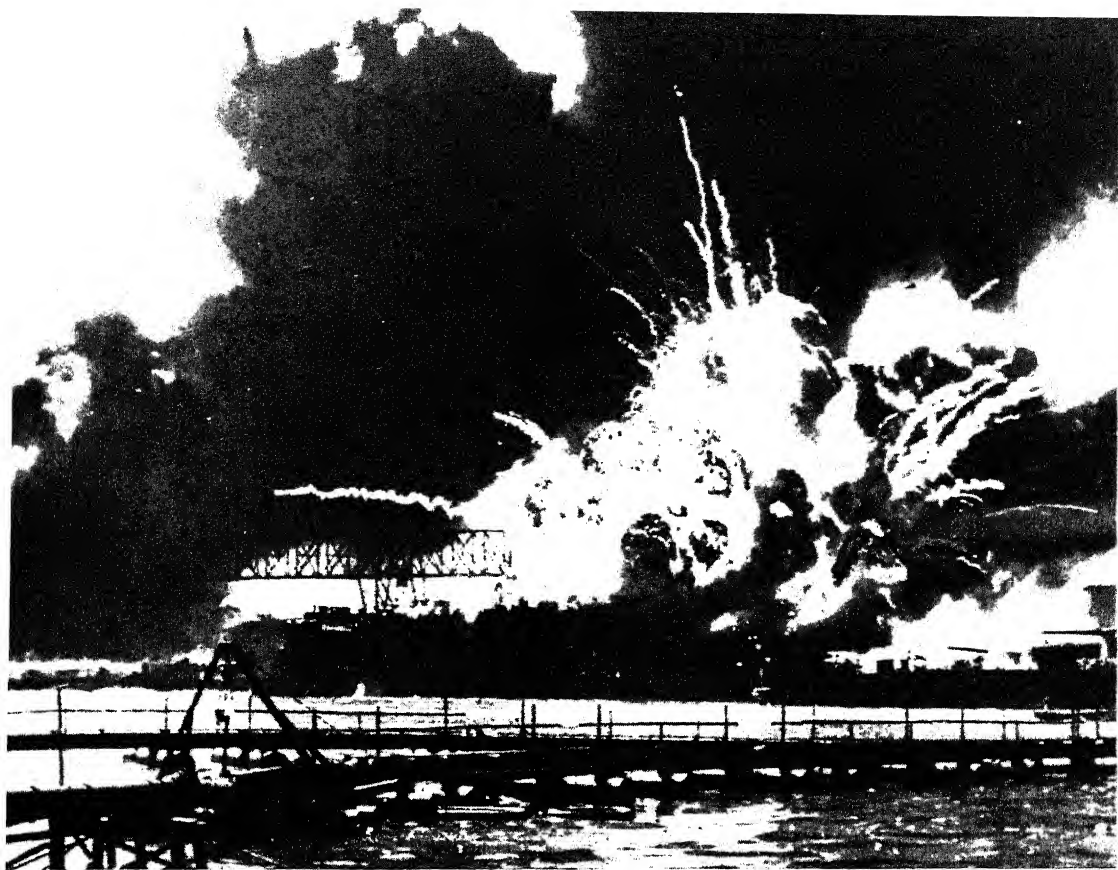
its intentions on the withdrawal of Japanese troops from China and French Indochina. The Japanese reply did not satisfy the U.S. and was rejected on Nov. 26 as offering no basis either for a peaceful settlement or even a temporary adjustment of the issues at stake. In rejecting the Japanese reply, the U.S. government made a series of eight proposals, considered by many historians to constitute a virtual ultimatum because of their obvious unacceptability.

On Nov. 27, Japan signed a five-year extension of the Anti-Comintern Pact with Germany and Italy. Reports of heavy Japanese troop concentration in southern French Indochina led President Roosevelt to ask the Japanese government on Dec. 2 for an explanation. The Japanese replied that the reports were exaggerated. On Dec. 6 Roosevelt appealed to the Japanese Emperor to "give thought in this definite emergency to ways of dispelling the dark clouds".

In the early morning hours of Dec. 7 Japanese diplomats in Washington met Secretary of State Cordell Hull to inform him that Japan rejected the American proposals of Nov. 26, that it could not accept the perpetuation of the "dominant position the United States had hitherto occupied not only in China but in other areas of East Asia", and that Japan considered it impossible to reach an agreement through further negotiation. While this meeting was in progress the long-planned Japanese attack on Pearl Harbor had already begun, largely without the knowledge of the Japanese diplomats or of most of the civilian government. In Japan, the government, largely influenced by the military forces, declared war on the U.S. and Great Britain.

The Japanese Attack. The Japanese aerial bombardment of Pearl Harbor completely surprised the American forces, resulting in the destruction of much of the U.S. Pacific fleet. Simultaneously the Japanese launched surprise naval and air attacks on the U.S. bases at Guam and at Midway and Wake islands, while Japanese army forces attacked Hong Kong, Malaya, and the Philippine Islands. The ultimate objective of the Japanese was thus made clear: the attacks were aimed at nothing less than the complete expulsion of the U.S., Great Britain, and all other Western powers from the Orient.

President Roosevelt appeared before Congress on Dec. 8, and in a brief, memorable address called for a formal declaration of war against Japan, referring to the Japanese assault as an "unprovoked and dastardly attack", and to the date of the attack as "a date which will live in infamy". Shortly thereafter, war declarations against the U.S. were issued by Germany and



An ammunition magazine explodes aboard the U.S.S. Shaw during the Japanese attack on Pearl Harbor on Dec. 7, 1941. On the following day, President Franklin D. Roosevelt requested the Congress to declare war on Japan. UPI

Italy; Congress formally declared war on those countries on Dec. 11, and the U.S. was thereupon fully engaged in the war against the Axis Powers.

The suddenness of the Japanese onslaught caught the U.S., British, and Dutch forces in the Far East almost totally unprepared. Guam and Wake Island were captured almost at once, Thailand cooperated with the Japanese, and the British were compelled to give up Hong Kong on Christmas Day, 1941. Large Japanese forces landed in the Netherlands East Indies, and by the end of 1941 the 200,000 Japanese troops invading the island of Luzon in the Philippines were already advancing on the capital city of Manila.

The Fall of the Philippines. Having immobilized the remnants of the U.S. Pacific fleet at Hawaii, and having shattered U.S. air forces in the Philippines by surprise bombardments of the U.S. airfields, the Japanese, quick to take advantage of their immunity from naval and air attack, brought overwhelming reinforcements into the Philippines. Manila fell on Jan. 2, 1942, and the American-Filipino defense forces, under Lieutenant General (later General of the Army) Douglas MacArthur, escaped an attempted en-

circlement by retreating to the difficult terrain of the Bataan Peninsula in southern Luzon. Cut off from all sources of supply, without air support, and outnumbered by five to one, the 43,000 U.S.-Filipino defenders stubbornly resisted the invaders for three months, upsetting the Japanese schedule of conquest and gaining precious time for Allied war preparations. Bataan fell on April 9, 1942; General MacArthur had shortly before been ordered by President Roosevelt to proceed to Australia and assume command of U.S. forces in the southwest Pacific. The defense command in the Philippines passed to Major General (later General) Jonathan Mayhew Wainwright, who succeeded in extricating some 7000 troops and 3000 civilians from the Japanese advance and withdrew to the island fortress of Corregidor in Manila harbor to make the final defense effort. After a bitter struggle lasting nearly a month, Corregidor was captured by the Japanese on May 6, 1942. The Japanese had thus won control of the Philippines, although American and Filipino guerrilla

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fighters were active in certain areas throughout the course of the war.

The Fall of Malaya. The invasion of Malaya, carried out by 100,000 well-equipped Japanese troops under General Tomoyuki Yamashita (1885–1946), proceeded rapidly against a force of 60,000 British, Australian, and Indian troops commanded by British Lieutenant General Arthur Ernest Percival (1887–1966). Japanese infiltration tactics and superiority of numbers and equipment forced the defenders to fall back on the British base at Singapore on Jan. 31, 1942. The defensive power of that fortress however, had been seriously weakened early in December when Japanese bombers sank the British battleship *Prince of Wales* and the battle cruiser *Repulse*. The defenses of Singapore had been planned, moreover, on the theory that the city could be attacked only by sea; its heavy guns were mounted so that they could be aimed only seaward and were therefore useless against the land-based attack of the Japanese. Singapore had fewer than 200 planes to meet the onslaught of more than 400 Japanese planes. After considerable preparation by aerial and artillery bombardment from the mainland, the Japanese launched their final assault on Singapore on Feb. 9, and General Percival surrendered unconditionally on Feb. 15. The capture of Singapore was perhaps the most important victory ever won by the Japanese, whose prestige in the Orient was greatly heightened by this humiliation of the British imperial forces.

The Fall of the Netherlands Indies. The East Indian Archipelago, rich in oil, rubber, copra, coffee, rice, and other resources, was a prime objective of the Japanese advance. The first Japanese landing in the archipelago was made at Sarawak, a small British protectorate in northwest Borneo, on Dec. 17, ten days after Pearl Harbor. After capturing the Dutch naval base at Amboina in the Moluccas, the Japanese began a series of air raids on other bases at Surabaya, Batavia, Palembang, and Kupang. Landings were also made by the Japanese in New Guinea, New Britain, and the Bismarck Archipelago, and the strategically situated naval and air bases at Rabaul, in New Britain, and at Kavieng, in New Ireland, were taken. By the end of February, the Japanese had attained control of Sumatra, Borneo, and Celebes; Java was captured on March 10.

The Burma Campaign. The Japanese launched the invasion of Burma on Jan. 15, 1942. The initiation of this action was motivated by three strategic objectives: the elimination of British forces in Burma, whose presence constituted a

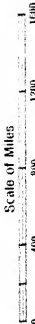
threat to the exposed Japanese flank in Malaya; the cutting of the Burma Road, over which most of the Allied supplies for China were transported, an act that would seriously hamper Chinese military operations; and the securing of Burma as an essential base for projected Japanese operations in India. The Japanese sent two columns into Burma from Thailand, one attacking through the south and the other advancing into central Burma toward the Salween R. The invasion proceeded rapidly against weak British and native resistance. Moulmein was taken on Jan. 31, and the two Japanese columns were thereupon joined. The hastily established British defense line along the Salween R. was broken after a fierce struggle, and on March 8 the Japanese occupied Rangoon. The invaders then dispatched a column to attack Lashio, the terminus of the Burma Road; that city was captured on April 28, effectively cutting the chief land connection between China and her allies. With the capture of Mandalay on May 1, the conquest of Burma was complete. The British withdrew to India and began preparations for a counteroffensive. American forces under Lieutenant General Joseph W. Stilwell played an important role in the campaigns in Burma.

Battles of the Coral Sea and Midway. In mid-April, 1942, U.S. intelligence, by deciphering Japanese codes, uncovered a Japanese plan to occupy Tulago in the Solomon Islands with one landing force, to seize Port Moresby with another force by invading through the Louisiade Archipelago, and to destroy any Allied force that might attempt to interfere with these landings. All U.S. naval ships available in Hawaii and the western Pacific, totaling about half the size of the Japanese forces, were sent to stop the Japanese. The ensuing battle on May 8 was one of the major sea-air engagements of the war in the Pacific; see CORAL SEA, BATTLE OF THE. The destruction of the Japanese fleets by U.S. carrier-based planes in this engagement temporarily halted the southward advance of the Japanese and furnished the U.S. with its first major victory of the war.

A second victory was won in June, 1942. Early in that month a strong Japanese task force was discovered approaching Midway Island. American land- and carrier-based planes attacked at once, launching a fierce battle that raged for four days; see MIDWAY ISLANDS. The final outcome of the battle was the complete defeat, with heavy losses, of the Japanese in their attempt to take Midway. The heavy losses inflicted on the Japanese fleet averted any Japanese assaults on Hawaii and also prevented the

Far Eastern Theater 1941-1945

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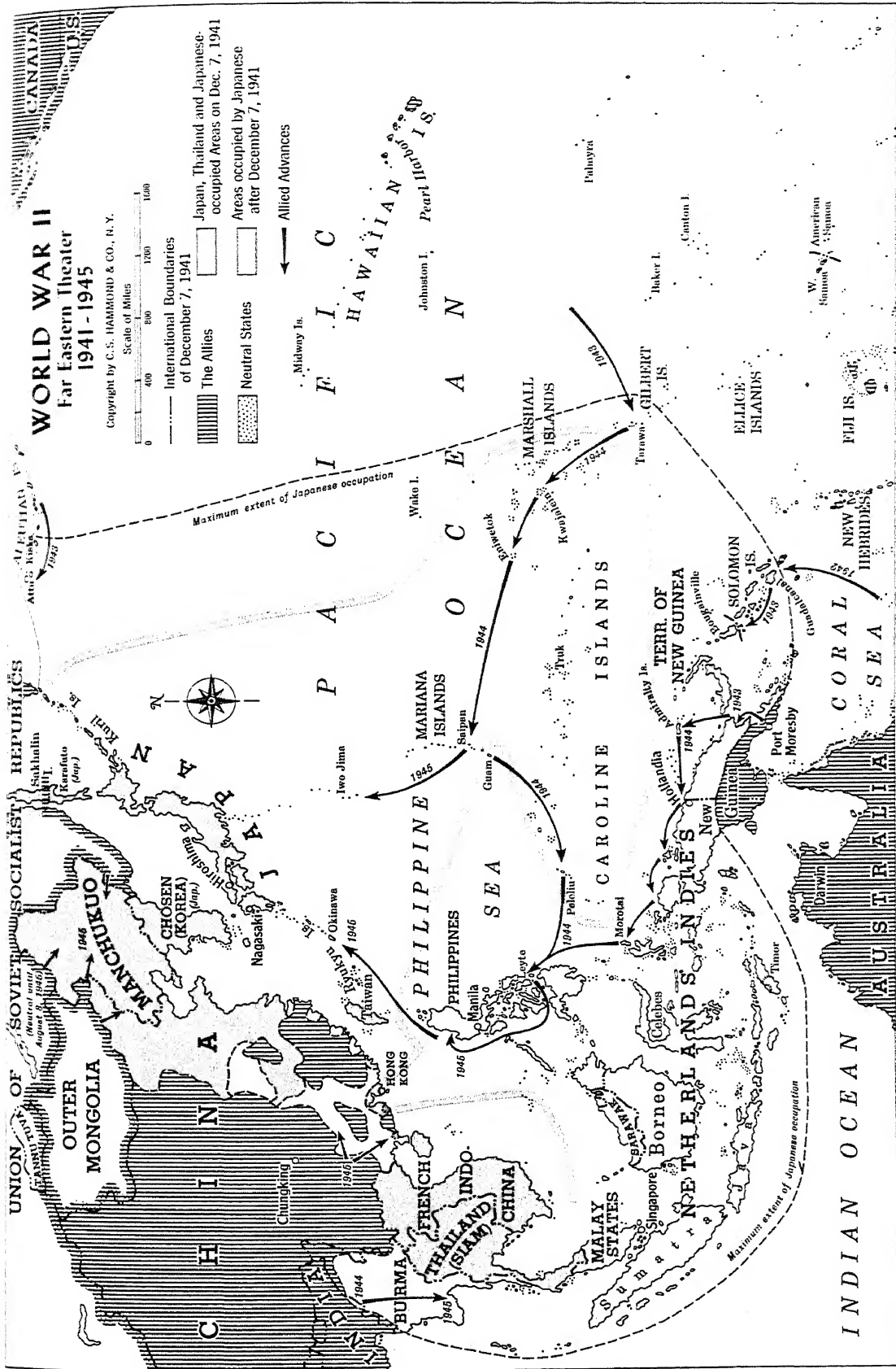


----- International Boundaries
of December 7, 1941

 The Allies
 Japan, Thailand and Japanese-occupied Areas on Dec. 7, 1941

 Neutral States  Areas occupied by Japanese after December 7, 1941

Allied Advances



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Japanese from supporting their forces in the South Pacific. From this time forth the Japanese forces were overextended throughout the Pacific and could never again muster sufficient naval strength to prevent the capture of Japanese bases by Allied amphibious movements toward Japan.

Battle of the Solomon Islands. The first offensive land action taken by the U.S. in the Pacific theater was the counteroffensive launched in August, 1942, against Japanese forces that had occupied the Solomon Islands in January, 1942. American Marine forces seized the Tulagi, Gavutu, and Tanambogo islands and established a beachhead on Guadalcanal (q.v.). For three months, despite powerful Japanese counterattacks and a severe shortage of supplies, the Marines held their ground. The final Japanese attempt to dislodge the U.S. forces was initiated in November with a combined land and sea attack, precipitating a bitter naval battle (Nov. 13–15), which resulted in a complete victory for the U.S. In a series of severe naval battles marked by heavy losses on both sides, the Allies then steadily pushed the Japanese out of one Solomon Islands base after another. The campaign culminated late in 1943 in the capture of Bougainville, marking the end of Japanese power in the Solomons and initiating the shift of American strategy from defensive operations.

Battle for New Guinea. The Japanese advance into the Solomon Islands in January, 1942, was followed early in March by landings on the island of New Guinea in preparation for an attack on Australia. By early autumn the Japanese armed forces had penetrated to within 35 mi. of Port Moresby, the strategically important Allied base on the southern coast of the island. General MacArthur, who had been appointed commander of all the Allied forces in this area, launched a successful counteroffensive on Sept. 25, driving the Japanese back to the north coast.

The major Allied offensive in New Guinea was opened in June, 1943, with a series of amphibious operations that captured the Japanese bases at Lae and Salamaua, on the northeast coast of the island. While MacArthur was gaining control of the Huon peninsula and the northern coast of New Guinea with rapid naval, air, and amphibious attacks, naval forces under Admiral William Frederick Halsey gained control of the Solomon Islands. The great Japanese base at Rabaul was thus brought within easy striking distance of several U.S. bases and cut off from all possibility of reinforcement. The Americans therefore simply bypassed Rabaul, which remained isolated and powerless.

The Chinese Front. The Japanese advances in Southeast Asia and the South Pacific resulted in the transfer of large quantities of military supplies, which would otherwise have been furnished to the embattled Chinese armies, to Allied forces in other areas. Nevertheless, the Chinese, under the leadership of Chiang Kai-shek, continued their effective war of attrition against the invaders and were even able to score a decisive victory over the Japanese at Changsha. At the beginning of 1942 the Chinese were engaging 57 Japanese army divisions, comprising about one third of the entire army of the Japanese empire. In January a Japanese mechanized force of 100,000 troops marched on Changsha. Despite the inadequacy of their armament, the Chinese routed the attackers, who suffered a loss of about 57,000 casualties. Although this victory heartened the Chinese, the cutting of the Burma Road in April, 1942, was a severe setback to their hopes for sufficient supplies to make possible the early expulsion of the enemy. Subsequent Chinese actions against the invaders received valuable air support from U.S. bombing forces stationed at secret air fields in China, and especially from the so-called "Flying Tigers" organized by Brigadier General Claire Lee Chennault.

The Aleutian Campaign. The first landing by Axis forces on North American soil occurred in June, 1942, when the Japanese occupied the western Aleutian islands of Attu, Agattu, and Kiska. American operations against the invaders during the remainder of 1942 were restricted to harassing air and naval attacks on their sea lines of supply and their installations. The Japanese, finding their forces overextended, were compelled to abandon Agattu in October. In January, 1943, U.S. army forces occupied Amchitka Island, about 70 miles s.e. of Kiska, as a base for the projected assault on the enemy-occupied islands. The final attack was launched on May 11, 1943, with a landing in force on Attu, where the entire Japanese occupation force was wiped out in a violent struggle lasting until May 30. In mid-August a joint U.S.-Canadian force landed on Kiska to find that the Japanese had earlier abandoned the island to avoid the fate of the Attu garrison. No landings were ever effected in North America thereafter by the Axis armies.

THE WAR IN AFRICA

Simultaneously with the entry of the U.S. into the war and the spread of conflict to southeast Asia and the Pacific, a number of significant campaigns were conducted in east Africa. During most of 1941 the situation in Libya was static, with advance units of German and Italian

forces, under Rommel, based at Salûm on the Egyptian border, and the British forces, under Wavell, holding advance posts at besieged Tobruk, about 50 mi. to the west. The British launched a major offensive in November, 1941, and, after establishing contact with the garrison at Tobruk, quickly drove the enemy back almost 350 mi. to El Agheila. There, after receiving reinforcements and tanks, planes, and artillery, Rommel halted the British onslaught.

Rommel's counteroffensive began in May, 1942. He succeeded in destroying four fifths of the British tank force, and in an advance headed by the Afrika Korps drove the British back to El Alamein, well within the Egyptian border and only 70 mi. from Alexandria and 300 mi. from the Suez Canal.

Soon afterward, in August, 1942, General (later Field Marshal) Bernard Law Montgomery was placed in command of the British Eighth Army in Egypt, as second-in-command under General (later Field Marshal) Sir Harold Rupert Leotric George Alexander, British commander for the entire Middle Eastern theater. Montgomery opened the next phase of the campaign on Oct. 22 with a four-day artillery bombardment followed by a frontal assault against the 40-mi. Axis front at El Alamein. In the air, his assault was supported by powerful U.S. and British fighter and bomber forces. Two weeks of bitter combat ensued, at the end of which the Germans were in full retreat. Many prisoners and large quantities of matériel were taken by the Eighth Army as they pressed the fleeing Afrika Korps westward. Six Italian divisions that had been supporting the German mechanized forces, but had been abandoned by them, surrendered en masse. On Nov. 8, Rommel found himself confronted with a new danger: powerful U.S. and British forces had landed in Morocco and Algeria (see below) and were preparing to advance against him from the west. After fighting a final delaying action at El Agheila, he hurriedly abandoned Libya to the Eighth Army, and in January, 1943, withdrew to a new defense line in eastern Tunisia.

The monumental struggle at El Alamein was one of the decisive battles of World War II. It ended for all time the Axis threat to Egypt and the Suez Canal, resulted in the weakening of the vaunted Afrika Korps, and facilitated the conquest of all North Africa by the Allies.

The Allied Invasion of North Africa. The Allied landings in Morocco and Algeria marked the culmination of the greatest naval, sea-and-air transport, and amphibious operation undertaken up to that time. The operation had been

planned at a conference held in June, 1942, in Washington, D.C., at which President Roosevelt and Prime Minister Churchill, with their respective staffs, had discussed the project in detail. American Lieutenant General (later General of the Army) Dwight David Eisenhower had been appointed to command the entire operation. About 150,000 American and 5000 British troops were involved; they were transported to their landing points by 500 troop transports escorted by 350 warships. Several thousand additional troops were transported by air from the British Isles to the scene of operations. The assembling of the troops and supplies was effected at ports in England, Northern Ireland, and in the eastern U.S. The gigantic armada that sailed secretly from these ports early in November held its rendezvous at Gibraltar, and proceeded to the actual landings.

American troops landed near Oran and Algiers, in Algeria, and near Casablanca, in Morocco, during the early hours of Nov. 8, 1942. Under the covering support of U.S. and British dive bombers, tanks and other mechanized equipment were also landed, and the attack began. Secret negotiations that had been conducted by Allied officers with the French authorities in Algiers for some months prior to the invasion culminated in the capture of Algiers a few hours after the first landings, by Admiral Jean Louis Xavier François Darlan. At Oran considerable initial resistance was met, but the strength and mobility of the invading forces quickly overcame the French defenders, and the city was taken on Nov. 10. At Casablanca, however, the French army commander sternly suppressed an uprising of pro-Allied French troops, and ordered all-out resistance. The French shore batteries and the warships anchored in the harbor loosed heavy fire on the landing forces, causing considerable damage. The fighting in and around Casablanca lasted four days. The city was finally surrendered on Nov. 11, on the receipt of direct orders from Admiral Darlan to cease all resistance. Thus, at the end of four days of fighting, 1500 mi. of coastline and all of French North Africa except Tunisia had come under the control of the Allies, providing the base for an Allied invasion of southern Europe.

The Tunisian Campaign. Immediately after securing their bases at Casablanca, Oran, and Algiers, the Allies raced for Tunisia, hoping to arrive before Rommel could consolidate his position and organize his defense. At Faïd Pass, in central Tunisia, however, a German armored division advanced 18 mi. through the American lines. After halting a counterattack by U.S. tanks,

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the Germans quickened their advance and captured Kasserine Pass. The German panzers were finally stopped by veteran British ground units, U.S. artillery, and U.S.-British air raids.

Meanwhile, the British Eighth Army was attacking Rommel along the Mareth Line, the defensive position he had established in southeastern Tunisia. The two-pronged Allied offensive prevented Rommel from concentrating reserves for use against either enemy, and presaged his quick defeat. On March 29 Montgomery outflanked the Mareth Line, forcing the Germans northward. In western Tunisia, the U.S. troops recaptured Faïd Pass on April 11. By May 3 they had taken Mateur.

Tunis and Bizerte were taken by the Allies on May 7, almost exactly six months after the Allied landings. The remaining Axis troops crowded into Cape Bon at the northern tip of Tunisia, hoping in vain for the arrival of sufficient Axis shipping to remove them. Allied planes, warships, and submarines made certain that such aid could not arrive, and the Axis forces were compelled to surrender in ever-increasing numbers. About 267,000 Axis troops were captured in the entire campaign, most of them during the closing days. The U.S. army lost 18,558 casualties, including 2184 dead. The British estimated that the entire African campaign had cost the Axis 750,000 men and enormous quantities of supplies. The Allies were in position for an assault from the south on Hitler's "Fortress Europe".

CONCLUSION OF THE WAR IN EUROPE

After the victory in Africa the Allies launched an immense offensive in Europe, resulting in the formation of three major fronts, and accompanied by a number of momentous political decisions. These actions, of course, were carried on simultaneously with the war against Japan.

The Casablanca Conference. From Jan. 14 to 26, a major conference was held in the recently captured city of Casablanca by President Roosevelt, Prime Minister Churchill, and their military staffs. Also in attendance at the conference were the leaders of the Free French forces, General de Gaulle and General Henri Honoré Giraud. Numerous important military decisions concerning the plans and coordinated operations of the Allies were taken at the conference and two major political decisions were made. Agreement was reached on the establishment of the French Committee of National Liberation, which was to organize and lead the Free French armed forces; de Gaulle and Giraud were to serve as copresidents of the Committee. Of

major consequence was a declaration announcing that the Allies were determined to continue their close cooperation against the Axis powers until the latter were driven to unconditional surrender. This declaration, the contents of which were communicated to Stalin and Chiang Kai-shek, indicated that the Axis powers would not be permitted to negotiate surrender terms, but would be compelled to throw themselves completely on the mercy of the victorious Allies. Several historians have concluded that this demand for unconditional surrender may have prolonged the war by stiffening the resistance of the Axis nations.

Phases of the Russo-German War. The period of the Allied victories in North Africa was also a time of crucial events along the 3000-mi. front in the Soviet Union. After checking the German blitzkrieg before Moscow, the Soviet army launched its first major counteroffensive in November, 1941, under the command of General Georgi Konstantinovich Zhukov. With the onset of the bitter Russian winter, the Soviets enjoyed a decided advantage. The Germans had expected to smash the Soviet armed forces with ease and rapidity and had not prepared for a winter campaign. Their troops were often without proper clothing and suffered agonizingly from the cold. The Red Army, on the other hand, was well equipped for winter fighting, and its men were inured to low temperatures.

Under the command of Marshals Timoshenko and Voroshilov, the Soviet Army struck along the entire front. The Germans fought back ferociously, but were compelled to retreat. Rostov, the great industrial city of the Don R. basin and gateway to the Caucasus, was recaptured by Soviet troops early in the campaign. The German withdrawal was in no sense a rout, however; all along the front the Germans drew their forces back into prepared winter positions and managed to hold the key cities captured in their first onslaught. By March 15, 1942, the shock of the Soviet assault had largely been absorbed, and the Germans still occupied the cities of Bryansk, Orel, Kursk, and Khar'kov, and were still encircling Leningrad. Nevertheless, vast areas had been retaken by the Soviet troops, and the immediate threat to Moscow had been eliminated.

The spring of 1942 brought mud and swollen rivers, virtually halting operations by either side. Not until May 8 was the Wehrmacht able to launch its expected spring offensive. That its striking power had been seriously curtailed by the unprecedented losses of the previous campaigns was evidenced by the limitation of the new offensive to the southern half of the front;

never again would the Germans be able to attack along the entire 3000-mi. front. The German objectives in this attack were to win control of the Black Sea by the reduction of Sevastopol' in the Crimea; to occupy the Don R. basin, and thus drive a wedge between the southern and central Soviet armies; and to drive into the Caucasus and capture the rich oil fields of Groznyy and Baku.

Fourteen German divisions were hurled into the attack on Sevastopol' in June, 1942. After 250 days of desperate resistance, Soviet troops evacuated the ruined city early in July. The fall of Sevastopol' released a powerful air armada that was then available to cover the German assault on the second spring objective, the basin of the Don. Four German armies, supplemented by Hungarian, Rumanian, and Italian troops, constituting a force of 2,000,000 men, were thrown into this advance. The main thrust was aimed at Voronezh, on the east bank of the Don R. The Germans claimed to have taken the city on July 7, but the Russian resistance was so obstinate that the Germans never actually held the city for more than a few days. Elsewhere, the German advance repeatedly threatened the Soviet army with encirclement, but Marshal Timoshenko prevented any such disaster by a succession of withdrawals. Late in July the Soviet army evacuated Rostov, and soon afterward the entire lower Don basin was in German hands. The way appeared open for Hitler's drive into the Caucasus.

The advance of the German panzers into the Caucasus was unusually rapid, because the Soviets had withdrawn the bulk of their southern armies to the line of the Volga and were preparing for an all-out defense of the oil fields in the Caspian area. Maykop, which supplied 7 percent of all Soviet petroleum, was taken on Aug. 9, and from that point the German armies rapidly fanned out toward the southwest. By Oct. 1 the Germans had occupied a large segment of the Caucasus, but had failed to attain their objective. Fierce Soviet counterattacks had halted the forward movement of the panzers, and the Groznyy and Baku oil fields, furnishing 13 and 75 percent of Soviet oil, respectively, were still occupied by Soviet troops.

While the rapid German advance was taking place in the Caucasus, the northern wing of the panzer armies was attacking a great concentration of Soviet forces in the bend of the Don R. The Soviet army fought hard to slow the oncoming Germans in this area, but was careful to avoid being trapped by the panzers in the natural pocket formed by the great bend of the river.

By mid-August the Soviet troops in this area had completed a withdrawal toward Stalingrad (now Volgograd; q.v.) and the Germans had succeeded in reaching the Don, although at great cost.

The Battle of Stalingrad. In their plan for taking Stalingrad the Germans envisaged three strategic objectives. The capture of Stalingrad would cut the last rail link between the central Soviet Union and the Caucasus, drive a wedge between the Soviet troops in the Caucasus and those to the north, and deprive the Soviet army of the use of the Volga for transporting the troops and matériel so badly needed by the armies keeping the Germans from the complete conquest of the Caucasus. Thirty-five of the finest divisions of the Wehrmacht, under Colonel General (later Field Marshal) Friedrich von Paulus (1890-1957), were sent against Stalingrad. German artillery and bombing planes demolished block after block of modern buildings and factories, seeking to dislodge the Soviet troops holding the city. As the German tanks and infantry fought their way into the suburbs and then into the center of the city, the workers of Stalingrad armed themselves and joined the soldiers on the firing line. Fighting with unprecedented ferocity, the outnumbered defenders took a heavy toll of the attackers and repeatedly drove them back, but were ultimately forced to yield before the sheer weight of numbers and armored equipment on the side of the enemy. By mid-November the defending force had been greatly reduced and was barely able to hold positions on the banks of the Volga.

The Soviet plan of defense called for a counteroffensive designed to annihilate the attackers. In great secrecy, the U.S.S.R. deployed four army groups to the north, northwest, and south of Stalingrad. Vast quantities of artillery, long the favorite and most dreaded weapon of the Soviet army, were placed at strategic locations on the flanks of the German armies. The first blows of the counteroffensive were to be aimed at those sections of the front manned by Rumanian, Hungarian, and Italian troops, who were known to be considerably inferior to the Germans in equipment and fighting spirit.

All preparations having been completed, the counteroffensive was launched by Zhukov on Nov. 19, at the very moment when the defense of Stalingrad appeared on the verge of collapse. First to strike was the Soviet army deployed on the northern flank of the German armies; it was followed on Nov. 20 by the forces on the northwestern and southern flanks. Taken completely unaware by the suddenness and fury of the So-



A Soviet trench mortar crew advances under fire to a new position during the Battle of Stalingrad in 1942. Russian armies defended their country against the Germans through two bitter winters, culminating in the brilliant victory at Stalingrad.

Wide World

viet onslaught, the Germans were unable to prevent the junction of the four Soviet army groups effected on the fourth day of the attack. Von Paulus and his entire Sixth Army, numbering about 330,000 men, were surrounded and cut off from the main German armies. All attempts by the Germans to break out of the rapidly tightening ring were defeated, and an effort on Christmas Day by seven German divisions to open an escape corridor from the outside was similarly fruitless. By the end of the year, Soviet forces in the Stalingrad area had killed 175,000 Axis troops, and had captured 137,650. On Jan. 31, 1943, convinced of the hopelessness of further resistance, Von Paulus surrendered his entire remaining force.

The Battle of Stalingrad is regarded by historians and students of military science as the turning point of World War II. Not only was it the most terrible disaster ever inflicted on a German army in a single operation; the battle for Stalingrad was the high-water mark of the tide of German military conquest, and the beginning of

that long series of Allied offensives in Europe that was to culminate in the total defeat of the Axis powers.

The Invasion of Sicily. After the surrender of Axis armies in North Africa in the spring of 1943, Allied armies in that area entered a period of intensive training while a vast armada was assembled for the projected invasion of Sicily. The ports and airfields of Sicily and various nearby islands were systematically bombed by planes based on widely scattered airfields in North Africa. On June 11, after twenty days of unrelenting air assault and several naval bombardments, the fortified Italian island of Pantelleria, 80 miles s.w. of Sicily, surrendered to the Allies to avoid further destruction. This great victory of Allied air and naval power greatly facilitated the preparations for the assault on the Sicilian mainland.

The Allied invasion of Sicily began during the night of July 9–10. Parachute troops of the U.S. 82nd Airborne Division were dropped at strategic points, from which they launched local attacks to divert the enemy from defense of the shoreline. The troops making the landings on the beaches were transported by about 3200 vessels, protected by aircraft and a large fleet of warships. British General Alexander was in command of the entire operation; Montgomery

commanded the British-Canadian Eighth Army which landed on the southeastern coast, while U.S. Lieutenant General (later General) George Smith Patton commanded the U.S. Seventh Army, which landed at Gela and Licata on the southern coast. Only token resistance was offered to the Allied advance by the Italian troops in Sicily, who displayed their developing opposition to the fascist regime of Mussolini and to the Germans by surrendering to the Allies in ever-increasing numbers. The three German divisions in Sicily, on the other hand, organized a determined defense of the island.

In the initial phases of the campaign, both of the Allied invasion forces pushed forward rapidly. The U.S. Seventh Army advanced quickly to the westward along the coast and, after overrunning Marsala, turned northward and captured Palermo on July 23, two weeks after the start of the invasion. The British moved with equal rapidity along the eastern coast until they reached Catania, on the slopes of Mt. Etna. Here they encountered a strongly entrenched German force, which, with the aid of the favorable terrain, succeeded in temporarily checking the British advance. Messina was taken by the Allies on Aug. 17, ending the Sicilian campaign thirty-eight days after the first landings.

The conquest of Sicily led to several strategic and political gains for the Allies. Almost the entire Italian navy, including five battleships, seven cruisers, and eleven destroyers, joined the Allies at Malta. Allied control of the western Mediterranean was greatly strengthened, and with the removal of the Italian navy from the Axis forces, a considerable part of the Allied navies was freed for operations against Japan. The Sicilian campaign, moreover, was the immediate cause of the downfall of the Mussolini government and the end of fascism in Italy.

The Fall of Mussolini. Combined with the crushing defeats inflicted on Italian armies in North Africa and the loss of Libya, the loss of Sicily precipitated a major political crisis in Italy. Criticism of Mussolini's conduct of the war intensified; peace demonstrations were held in many cities; strikes and sabotage in war industries increased. Late in July the Fascist Grand Council voted a lack of confidence in Mussolini's regime, and on July 25 King Victor Emmanuel III ordered the resignation of Mussolini and his government. The ousted dictator and a number of his chief aides were placed under arrest, and a new government headed by Marshal Pietro Badoglio was established. One of the first actions taken by the new government was the dissolution of the Fascist Party and of all other

fascist organizations and institutions. Badoglio announced that Italy would continue in the war on the side of Germany, but in the face of the mounting protest movement and the continued Allied advance in Sicily, he was forced to reverse this decision. On Aug. 15 he sent a representative to Lisbon, Portugal, with full authorization to offer to join the Allies after the Allied invasion of Italy had begun. This offer was accepted and an armistice between Italy and the Allies was signed on Sept. 3, but for political and other reasons was not made public until Sept. 8. For a detailed account of the events in Italy leading to the downfall of Mussolini, and for subsequent political developments in Italy, see *ITALY: History: World War II*.

The Italian Campaign. The date of the acceptance of Italy as a member of the Allies, Sept. 3, was also the date of the invasion of southern Italy by the British Eighth Army under Montgomery. After crossing the Strait of Messina and taking Reggio di Calabria, at the toe of the Italian boot, the British advanced northward along the western coast of Italy. On Sept. 9, the day after the publication of the Italian-Allied accord, an Allied invasion fleet so vast that its ships covered 1000 sq.mi. of the Tyrrhenian Sea approached Salerno, south of Naples. One U.S. and two British divisions of the Anglo-American Fifth Army, commanded by U.S. Lieutenant General (later General) Mark Wayne Clark, were landed at Salerno. They were immediately attacked by a powerful German panzer division, supported by two other divisions. The invading force seized the port of Salerno and established a narrow bridgehead 24 mi. long, which on several occasions was almost split by fierce German counterattacks. Aided by the overwhelming might of the Allied air forces, the invaders managed to repel the German attacks and to consolidate their positions, making possible the landing of additional troops and great quantities of supplies.

By Sept. 16 the Fifth Army had driven an 8-mi. wedge into the German lines, and on the following day a junction was effected between the Fifth and Eighth Armies. On Sept. 28 the British captured Foggia, the greatest air base in southern Italy, which had, however, been severely damaged by Allied air raids. On the eastern sector of the front, the Fifth Army took Naples on Oct. 2, after the Germans had thoroughly looted the city, burned much of it, and blocked the harbor with sunken ships. The Allies had thus established a continuous front extending across the Italian peninsula from Naples to the Adriatic coast.

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From this point, the Allied advance was slow, difficult, and costly. Muddy fields, rivers swollen by heavy rains, and the mountainous terrain combined to slow the Allies and aid the Germans, who resisted stubbornly at all points and on several occasions impeded the Allied advance by flooding the coastal areas from reservoirs in the hills. Allied gains were rarely more than 3 or 4 mi., each forward movement requiring the blasting and storming of heavily fortified German positions established on the commanding heights of the Apennines. By the end of 1943, U.S. troops had reached a point south of the town of Cassino, while the Eighth Army had captured the Adriatic port of Ortona. Confronting the slowly advancing Allies were two German armies, the Tenth and Fourteenth, commanded by Field Marshal Albert Kesselring (1887–1960). He had set up a formidable defense system extending across the breadth of Italy, and was prepared to delay and obstruct the Allied advance on Rome by every available means.

On Jan. 22, 1944, the Allies attempted to break the stalemate by making a surprise amphibious landing at the ports of Anzio and Nettuno, 30 miles s. of Rome and 60 miles n. of the main front. This tactic was aimed both at cutting the railway between Rome and the front, and at the envelopment of Kesselring's line from the rear. About 36,000 troops of the Fifth Army were landed during the first day, and a beachhead 20 mi. long and 8 mi. wide was established. German resistance was surprisingly light at first, but Kesselring quickly shifted troops from the main front to meet the new threat. By the beginning of February, the Allies had landed 92,000 troops in the beachhead, and the Germans had brought up 98,000 men to contain the landing force. The Germans were advantageously situated for the attainment of their objective; they used their interior lines of communication to shuttle troops rapidly between Rome, the beachhead, and the main front. No such flexibility was possible for the troops manning the beachhead, who were further hampered by shortages of supplies and heavy equipment because of the limited dock and harbor facilities available to them.

Both the beachhead and the main front remained relatively static until May, although the fighting was continuous and the suffering on both sides from cold and exposure was severe. The Allies launched their drive on Rome on May 11. The main force of the Fifth Army penetrated Kesselring's defenses and on May 25 effected a junction with the troops in the Anzio-Nettuno beachhead. From this point the Allied advance

proceeded steadily over the rugged terrain to Rome, which was captured on June 4. Rome was the first Axis capital to fall to the Allies. The German Tenth Army, however, escaped the Allied advance, enabling the Germans to continue the war in Italy for another year.

Having lost the psychological advantage of the possession of Rome, the German High Command decided on the abandonment of central Italy, which had little economic or strategic value. During the thirteen days following the fall of Rome, the German withdrawal enabled the Allies to advance 100 mi. on the western side of Italy and 50 mi. on the more difficult terrain of the eastern side. Thereafter the advance was slower but continued steadily through the rugged region of Tuscany to the Gothic Line, a series of defensive fortifications established by the Germans in the northern Apennines, constituting the last barrier between the Allies and the strategically important Po valley.

Prelude to Allied Invasion of France. The successive Allied campaigns in North Africa, Sicily, and Italy were accompanied by an ever-mounting air assault, by U.S. and British planes based in Great Britain, on industrial and military targets in Germany and throughout German-occupied Europe. The Allied air offensive was most heavily concentrated on the industrial Ruhr R. valley. On several occasions during 1942, the British R.A.F. mounted raids on key cities of the Ruhr involving more than 1000 planes. One of the chief targets was the giant Krupp armament works in Essen, which was repeatedly raided and suffered heavy damage; see also **KRUPP**. In 1943 the R.A.F. was joined by considerable numbers of U.S. bomber and fighter units; thereafter the R.A.F. was assigned the task of delivering night bombardments, while the U.S. air forces were used principally for daylight raids, making possible precision bombings of the target cities. By the middle of 1943, daily and nightly raids carried out by 700 planes had become a common occurrence. The industrial cities of Essen, Cologne, Dortmund, Nuremberg, Stuttgart, Hamburg, and many others were subjected to constant attacks, as were the submarine bases and ports of Kiel, Bremen, Wilhelmshaven, and Lorient. Meanwhile, long-distance bombers ranged as far as Norway and Crete and delivered numerous bombardments in support of the Allied troops fighting in Italy. Raids on Berlin were initiated in the summer of 1943 and continued with devastating effect until the end of the war. An immense Allied air raid on Dresden resulted in the virtual destruction of that city.



Major Allied powers of World War II confer in Tehran, Iran, late in 1943. Left to right: Premier Joseph Stalin of the U.S.S.R., President Franklin D. Roosevelt of the U.S., and Prime Minister Winston Churchill of Great Britain.
U.S. Army

During this period, however, the Germans were able to develop a number of new weapons, notably the jet plane (see AVIATION), the V-1 flying bomb or "buzz bomb", and the V-2 long-range rocket; see ROCKET. The latter caused considerable devastation when it was used against London and other British cities in 1944, but it had no strategic effect on the war. A German attempt to build an atomic bomb proved abortive.

The years 1942 and 1943, and the first half of 1944, were also a period of heated controversy between the Western Allies and the Soviet Union. Stalin and the other Soviet leaders, vocally supported by the Communist parties in the Western countries, insistently demanded the fulfillment of the Allied promise, given at several international conferences, of an Allied invasion of Western Europe. At Tehran, Iran (Nov. 28-Dec. 1, 1943), for example, Stalin urged Churchill and Roosevelt to institute an immediate invasion of France; see TEHRAN CONFERENCE. The Soviet leaders contended that their army was sustaining the brunt of the burden of the war, and that the failure of the Western Allies to open a "second front" was evidence of their desire to see the German and Soviet armies bleed each other to death, while the Allies husbanded their troops and equipment. The Western Allies, on the other hand, reiterated their determination to come to the aid of the U.S.S.R. by launching the promised invasion, but insisted

that so vast an undertaking as an assault on the "Atlantic Wall", the formidable defense system established by the Germans along the Atlantic shores of Europe, must be prepared with utmost care, necessitating the specialized training of literally millions of troops and the assembling in the British Isles of enormous quantities of matériel. The Allies pointed, moreover, to their devastating air war on Germany, which was contributing to the defeat of the German armies in the Soviet Union through the weakening of German industry and the disruption of German communications. Finally, the Allies reminded the U.S.S.R. of the vast amount of supplies furnished to the Soviet army by the U.S. under the lend-lease program.

D-Day. The long expected invasion of France was launched by the Western Allies on June 6, 1944. For months prior to that date, the British Isles had been the scene of intensive training maneuvers conducted by millions of American, British, Canadian, Free French, and other Allied troops. The islands were studded with hundreds of depots for the vast quantities of supplies and equipment needed for the campaign. In command of the entire operation was Eisenhower, designated Supreme Commander, Allied Expe-

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ditionary Forces; his chief aide was Montgomery, who had been appointed commander of the combined Allied ground force.

The target area of the invasion was the strip of Normandy coastline lying between Cherbourg and Le Havre. Throughout the night of June 5-6, the most intense aerial and naval bombardment of the entire war rained destruction on the German coastal defenses and rear areas, literally paralyzing the rail and communications network behind the shoreline. The invasion was spearheaded by Allied parachute and airborne infantry troops, who were dropped behind the Atlantic Wall to disrupt communications and seize vital defense installations. More than 4000 ships and several thousand smaller craft, as well as numerous constructions forming artificial harbors, were used in the invasion fleet, protected by about 11,000 first-line aircraft. The Channel waters in the path of the invasion were cleared by minesweepers and patrol boats, reducing losses to an absolute minimum. German air opposition to the invasion was insignificant.

The first assault troops landed on the beaches

shortly after dawn. The invasion army was divided into two striking forces: on the left was the British Second Army, which landed opposite the cities of Bayeux and Caen; and on the right, landing between the Cherbourg peninsula and Saint-Laurent, was the U.S. First Army. The strongest initial opposition was encountered by the V Corps of the First Army occupying the beaches between Grandcamp-les-Bains and Saint-Laurent; a German defense division, unaware that the invasion was impending, happened to be conducting maneuvers and was deployed for action at the very spot where the V Corps landed. The V Corps was prevented by this unexpected opposition from driving inland from the beachhead until the second day of the invasion, and suffered the severest losses of the entire invasion force. The second component of the First Army, the VII Corps, drove rapidly ahead after consolidating its beachhead, and on June 14 captured the important town of Carentan, thereby effecting a junction with the V Corps and establishing for the first time an unbroken front of the invading forces.

The Allied plan called for the capture of the port of Cherbourg as soon as possible. In conformity with this plan the U.S. 9th Division reached the west coast of the peninsula on June

General Dwight D. Eisenhower, supreme commander of Allied forces in Europe, gives a final briefing to paratroopers before their takeoff for France on D-Day, June 6, 1944, the beginning of the Allied invasion of German-occupied western Europe.

U.S. Army



18, and shortly thereafter repulsed a powerful attempt at a breakthrough by a German division trapped in the Cherbourg area. The VII Corps then moved northward and advanced on Cherbourg. The capture of that great port was one of the primary objectives of the entire campaign in Normandy, because the supplying of the great Allied army in Normandy had been rendered extremely difficult by the lack of adequate dock facilities. The city was taken by the VII Corps on July 2, and engineers were immediately brought in to repair the extensive damage wrought by the Germans before their surrender.

Meanwhile, the British had met powerful resistance at Caen, where the German commander, Field Marshal Rommel, had concentrated four panzer divisions. The subsequent fighting in the Caen area was markedly fierce and bloody; to meet the determined attack of the British Rommel increased his forces to seven panzer and four field divisions. The city was finally taken by the British on July 9, in a great offensive preceded by intense bombardment from the air and from ground and naval artillery.

Having conquered the Cherbourg peninsula, the U.S. First Army turned southward and on July 3 opened a general offensive against the German lines, which had been set up at the base of the peninsula by Rommel in such a way as to seal off the Allied armies. The breakthrough occurred after a great battle of armored units at Saint-Lô, in the closing days of July. After smashing the German defenses at Saint-Lô the Americans advanced swiftly, reaching Avranches, the gateway to Brittany, on July 30. At about the same time the British broke through the German center at Caumont, advancing to Vire. The path was then clear to Brittany, and the German attempt at containment of the Allies in the Cherbourg peninsula had been defeated. Shortly thereafter, General Eisenhower moved his headquarters from London to Normandy.

During the week following the breakthrough at St.-Lô, the U.S. Third Army, commanded by Lieutenant General Patton and comprising a number of the most powerful armored units in the U.S. army, was brought into action. The Third Army first saw action in the Avranches area, and then drove rapidly northward to Argentan, partially encircling the German armies facing the Allied lines at some distance from the base of the Cherbourg peninsula. At the same time the Canadian First Army occupied the road from Caen to Falaise, a town about 15 miles N.W. of Argentan. Thus the Germans found themselves in a pocket, the sole exit being the 15-mi.

gap between Falaise and Argentan. On Aug. 17 the Canadians took Falaise and closed that road to the Germans. During the ensuing ten days the Third Army fought against desperate German resistance to close the gap and finally effected a junction with the Canadians. In the entire battle of the Falaise-Argentan pocket, the Allies took more than 15,000 prisoners; British sources estimated that elements of between twelve and fourteen German divisions were destroyed or captured.

While this battle was proceeding, other Allied armies had conquered virtually all of Brittany. The Germans in Brittany concentrated their forces in the cities of Brest, Lorient, and Saint-Nazaire, seeking to delay as long as possible the Allied seizure of these valuable ports.

Invasion of Southern France. While the Allied campaign progressed from the beaches of Normandy into France proper, an invasion of southern France was in preparation in North Africa and Italy. Assembly of the invasion fleet was begun in July, the main force gathering in the harbor of Naples. The entire fleet comprised more than 1000 ships and craft of all types. Four days of intense aerial bombardment were followed during the night of Aug. 14-15 by Allied landings east of the mouth of the Rhône R. The invasion was conducted by the U.S. Seventh Army, which included, besides several U.S. divisions, the Free French II Corps. The landings met comparatively light resistance, and parts of the landing force moved swiftly northward toward Grenoble. After several delaying actions, the German Nineteenth Army withdrew up the Rhône to the vicinity of Épinal and Belfort in order to defend the Belfort Gap and thus prevent the Allies from approaching the southwestern border of Germany. The German First Army, which had also been stationed in southern France, kept to the west and north of the Nineteenth as the latter withdrew, and set up a defense line on the Moselle R., leaving garrisons to hold Bordeaux and La Rochelle as long as possible. The Nineteenth left garrisons at Toulon and Marseille.

Liberation of France. The disengaging movements carried out by the German armies in southern France, coupled with similar movements by the armies in the north, indicated that the German High Command had decided to withdraw almost completely from France. In northern France, after leaving garrisons to delay the Allied capture of the ports of St.-Nazaire, Brest, Lorient, Le Havre, Calais, Dunkirk, and Boulogne, the Germans withdrew to a line generally following the Dutch border from the Eng-



General Charles de Gaulle, leader of the Free French troops, heads a parade on the Champs Élysées marking the liberation of Paris in 1944.

Wide World

lish Channel to Aachen. While this large-scale withdrawal was taking place, the Allied forces moved forward into central France. In Paris, fighters of the French Resistance movement launched an uprising against the German garrison which lasted for four days until the arrival on Aug. 25 of the Free French Second Armored Division, to which the Germans surrendered the city. Soon afterward General Eisenhower issued a report on the entire campaign in France thus far, announcing that the equivalent of five panzer and twenty infantry divisions of the Wehrmacht had been destroyed and numerous others decimated; total enemy casualties amounted to over 400,000 dead, wounded, and captured. In the air, a heavy toll had been taken of the Luftwaffe; more than 3500 German planes had been destroyed.

By mid-September the Allied advance, following closely behind the retreating Germans, had brought six armies to the German border. Belgium and the southern Netherlands had been penetrated. The Allies, however, faced a formidable barrier blocking their entry into Ger-

many: the Siegfried Line or West Wall, a series of strong defensive fortifications. On Sept. 17, the First Allied Airborne Army, including U.S., British, and Polish units, attempted to outflank the German defense system by landing behind the Rhine R. at points near Arnhem and Nijmegen in the Netherlands. The attempt ended in failure, because the Germans quickly moved reinforcements to the endangered area, prevented a junction of the airborne force with the main Allied armies, and destroyed the troops that had been landed. Elsewhere, Allied progress was slow and costly, but steady. Aachen, the first major German city to fall, was taken late in October, and Metz and Strasbourg in November. The Allied armies driving forward from southern France succeeded in forcing the Belfort Gap and several passes through the Vosges Mts.

The "Battle of the Bulge." General Eisenhower's plans for a final offensive against Germany were suddenly disrupted in mid-December, when Field Marshal Karl Rudolf Gerd von Rundstedt (1875-1953), commander of the German armies on the western front, launched a surprise offensive in the Ardennes Forest. Striking against a lightly held portion of the Allied line, the Germans quickly advanced 50 mi. into Bel-

gium and Luxembourg. The immediate German objectives were the Belgian towns of Liège and Namur; the ultimate goal was the vital seaport of Antwerp. The Allied armies halted the German drive short of these objectives and launched a pincer movement against the base of the "bulge" created by the German advance. The U.S. Third Army attacked from the south on Dec. 23, and on Jan. 3 the First Army attacked from the north. Despite desperate German resistance, the entire salient was eliminated by the end of January. The Germans had lost 220,000 men in this battle, and large quantities of mechanized and other heavy equipment. The Ardennes offensive marked the last occasion on which the Wehrmacht was able to initiate a major offensive on any front.

German Retreat from Eastern Europe. The advances of the Western Allies in Italy and France were accompanied by successive offensives of the Soviet army against the badly weakened Wehrmacht. Throughout the years 1943 and 1944, all attempts of the Wehrmacht to regain the initiative on the eastern front were frustrated, and the Soviet forces drove relentlessly forward, recapturing vast areas and liberating most of the major cities of the U.S.S.R. By the end of 1943 the Soviet army was approaching the Polish border and was poised for the re-

conquest of the Ukraine. One year later the Baltic states had largely been overrun; Finland, Rumania, and Bulgaria had been compelled to surrender to the invading Soviet forces and Soviet troops had reoccupied the Ukraine and conquered large areas in Poland, Hungary, and Czechoslovakia. With the aid of the Yugoslav Partisan army, a guerrilla force led by Marshal Tito, much of Yugoslavia had been cleared of the Germans. The Allied invasion of France in June, 1944, materially aided the U.S.S.R. in quickening the pace of its onslaught, because the invasion armies engaged large numbers of previously idle German troops and caused the Germans to suffer enormous losses of planes and equipment. Germany was thus besieged from the east, south, and west, and the ever-increasing might of the combined Allied air fleets was shattering the German communications system and paralyzing German industry.

The Battle of Germany. On Jan. 12, 1945, the Soviet army opened a mighty offensive aimed at the final destruction of the German armies on the eastern front and at the capture of Berlin. In accordance with a plan formulated jointly by

Colonel General Alfred Jodl (1890?–1946), German chief of staff, signs documents of unconditional surrender of all German forces at Reims, France, on May 7, 1945.

U.S. Army



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the Soviet and Western Allied commands, the Allied armies poised on the western border of Germany launched an equally powerful assault on Feb. 23. By early March the Western Allies had penetrated the Siegfried Line and reached the Rhine at several points. On March 7 a fast-moving armored task force of the U.S. First Army reached a railroad bridge over the Rhine at Remagen that the Germans had not had time to destroy completely. This fortunate circumstance greatly facilitated the Allied advance; the partially demolished bridge remained usable for five days, during which considerable numbers of U.S. troops were able to cross the river and pursue the Wehrmacht. The Rhine was crossed at numerous additional points soon afterward, and the Allied armies moved forward at an accelerated pace, meeting only scattered opposition from the demoralized Germans. In the east, the Soviet offensive swept on unchecked; by the beginning of April Soviet forces had conquered all of East Prussia and much of German Silesia and had reached a point only 30 miles E. of Berlin.

Victory in Europe. The Soviet army began the final advance against Berlin on April 19; two days later Soviet troops entered the outskirts of the city. On April 26 occurred one of the most momentous events of the closing days of the European war: the meeting of American and Soviet troops at the town of Torgau on the Elbe R., about 70 miles S. of Berlin. Hitler committed suicide on April 30, and the last defenders of Berlin surrendered to Soviet soldiers on May 2. On May 7 the German High Command announced its acceptance of the Allies' unconditional surrender terms. The instruments of surrender were signed at two formal ceremonies held on May 7 at General Eisenhower's headquarters in Reims, France, and on May 8 at the newly established Soviet headquarters in Berlin.

The advance into Germany was marked by the liberation of many concentration camps at which the Germans had inflicted on political prisoners and on victims of their genocidal race policies crimes unequalled in human history. The horror provoked by these atrocities was a factor in the war-crimes trials (q.v.) held after the war in Nuremberg and other cities.

DECISIVE PHASES OF THE WAR AGAINST JAPAN

The great victories won by the Allied armies after the turning of the tide against the Axis in Europe and Africa were paralleled by a succession of victories scored in the course of a far-flung offensive against the Japanese forces in the Pacific and Asiatic theaters. The Allied oper-

ations in these areas were carried out under four separate but closely coordinated commands. General MacArthur was in charge of operations in the southwest Pacific; U.S. Admiral Chester William Nimitz was in command of the central Pacific operations; British Lord Louis Mountbatten headed the Allied forces in southeast Asia; and the Allied campaigns in China were under the command of Generalissimo Chiang Kai-shek.

"Island-Hopping" in the Pacific. The strategic objective of campaigns in the central and southwest Pacific was to obtain island bases close to the Japanese home islands, for use both as bases for the aerial bombardment of Japan, and as mobilization and departure points for the projected invasion of Japan. Admiral Nimitz launched the offensive in the central Pacific in November, 1943, with the invasion of the Gilbert Islands. After heavy air and naval bombardments, landings were made by U.S. Marines on Nov. 22 on the coral atolls of Makin and Tarawa (q.v.). Three days of bloody fighting ensued, during which the desperate Japanese garrisons inflicted heavy losses on the U.S. forces. So fanatical was the Japanese resistance that the Marines were compelled to wipe out virtually the entire defending force, taking very few prisoners, before the islands could be secured.

Proceeding in a generally northwestward direction across the central Pacific, Nimitz' forces next invaded the Marshall Islands on Jan. 31, 1944. The principal objective in this campaign was Kwajalein, the world's largest atoll, 66 mi. long and 18 mi. wide. The fighting on Kwajalein and the lesser islands of the Marshall group was similar to that of the Gilberts campaign in its fierceness, but the result was equally certain. The superiority in numbers and equipment of the U.S. air, naval, and ground forces sufficed to prevent any aid from reaching the beleaguered defenders, and the advance of the invaders against the Japanese, although difficult and costly, was relentless. By Feb. 6 all key points in the islands except Eniwetok, the most northerly of the group, had been conquered. The latter island was invaded on Feb. 16 and was completely cleared of the enemy in six days.

The next Allied objective in the central Pacific was the Mariana Islands. In preparation for this campaign, a powerful air assault was begun on Feb. 16, 1944, on Truk, the most powerful Japanese bastion in the central Pacific. This aerial onslaught continued for some months, effectively neutralizing Truk as a base of opposition to the advance across the central Pacific. Nimitz launched the invasion of the Marianas with

landings on Saipan (q.v.), about 1000 miles w. of Eniwetok, on June 15. One U.S. Army and two Marine divisions were landed; the subsequent fighting ranked with the severest in the Pacific war. After more than three weeks, organized Japanese resistance on Saipan came to an end, but sniping and minor skirmishes with remnants of the Japanese garrison continued for some time thereafter. The land action was accompanied by a major engagement known as the Battle of the Philippine Sea, in which the Japanese, using inadequately trained forces, attempted to destroy the U.S. Fifth Fleet. Suffering severe losses, the Japanese lost control of the sea. On July 20 U.S. forces began the reconquest of Guam, the American outpost in the Marianas that the Japanese had seized early in the war. The invaders again met desperate resistance, but were aided considerably by land-based air force elements operating from newly conquered Saipan. Three days after the landings on Guam, the island of Tinian was invaded. Organized resistance on Tinian ended on July 31, and the conquest of Guam was completed by Aug. 9.

Simultaneously with the campaigns in the central Pacific theater, General MacArthur conducted a series of successful operations in the southwest Pacific. On Dec. 26, 1943, he sent a powerful force of Marines against Cape Gloucester, the western tip of the island of New Britain, less than 100 miles N.E. of New Guinea. Japanese resistance was quickly overcome, and captured Japanese air fields provided advanced bases for bombings of the key Japanese base of Rabaul, on the northeastern tip of New Britain. MacArthur then began an advance along the coast of New Guinea. On Jan. 3, 1944, his forces made a surprise amphibious landing at Saidor, about 110 miles N. of the previously captured base at Finschhafen. The success of this landing gave the Allies a new harbor and airfield 55 mi. below the Japanese stronghold at Madang; the Japanese forces holding the intervening territory were encircled and cut off from their sole source of supply.

On Feb. 14 a force of U.S. and New Zealand troops invaded and quickly secured Green Island, about 200 miles E. of Rabaul, thereby flanking that Japanese bastion from still another direction. The final isolation of Rabaul was effected after the invasion by MacArthur's forces on Feb. 28 of the Admiralty Islands, about 250 miles N. of the newly won Allied positions on New Guinea, and an approximately equal distance west of Rabaul. The occupation of the Admiralties was virtually completed by the end of

April. The Japanese Eighth Army based at Rabaul was now completely cut off from all contact with the Japanese Eighteenth Army, based on Wewak on New Guinea.

MacArthur then turned the full weight of his forces against the Japanese on New Guinea. While the Japanese awaited his attack at their Wewak stronghold, he "leap-frogged" beyond them and struck at Hollandia (now Djajapura) and Aitape on April 22. After six days of hard fighting all airfields and other installations in these areas were in Allied hands. This flanking operation shut off about 60,000 Japanese troops between Aitape and Madang, preventing them from interfering with future Allied advances along the coast of New Guinea. Continuing his westward march, MacArthur seized the Wakde Islands, 115 miles W. of Hollandia, in an operation lasting from May 16 to 19. Biak Island, 180 mi. farther west, was taken on May 27. The advance progressed steadily from this point until the invasion on July 30 of Cape Sansapor, on the western tip of New Guinea, about 600 mi. from the Philippines. With the crushing of enemy resistance at this point, virtually all of New Guinea had been consolidated as a base for future Allied operations in the Pacific and particularly in the Philippines. The final steps leading to the assault on the Philippines, the invasion and occupation of the Halmahera and Palau islands, were taken during September.

Invasion of the Philippines. The landings by MacArthur's forces in the Philippines were preceded by several weeks of unremitting Allied air and naval attacks on Japanese defenses at strategic points in the islands. The actual invasion, constituting the greatest amphibious operation yet undertaken in the Pacific theater, began on Oct. 19. The initial objective was the island of Leyte, in the central Philippines. The landings on Leyte were made by elements of the U.S. Sixth Army, commanded by Lieutenant General Walter Krueger (1881–1967). In supreme command of the Japanese occupation forces was General Tomoyuki Yamashita, well known to the Allies for his lightning conquest of Malaya.

After three days of fighting, a considerable area adjoining the east coast of Leyte had been cleared. On the third day of the invasion General MacArthur established his headquarters on the island; he was accompanied by the Filipino statesman Sergio Osmeña (1878–1961), who set up a temporary capital of the Philippine Commonwealth government at Tacloban. By Nov. 2 almost the entire eastern half of the island was in U.S. hands. The Japanese subsequently established a strong defense line in the northwestern

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corner of the island around the coastal town of Ormoc. On Dec. 7 elements of the U.S. 77th Division outflanked the Japanese defense line by making a surprise landing in Ormoc Bay. Thereafter, the entire Japanese defense system was quickly disrupted, and the conquest of the island was declared completed on Dec. 24.

Meanwhile the Fifth Fleet captured Peleliu and Ulithi by amphibious attack after heavy fighting. The fleet, under Halsey, shelled the airfields and destroyed the remaining land-based aircraft in the Philippines and Formosa with carrier aircraft, exposing the weakness of Japanese air power over the Philippines. The U.S. then decided to invade Leyte ahead of schedule and ordered Nimitz and MacArthur to attack on Oct. 20.

The Japanese, despite their losses at Midway and the Philippine Sea, realized that national defeat was inevitable unless they could destroy the American fleets. Soon after the initial American landings, therefore, the Japanese High Command decided on an all-out attempt to destroy the vast Allied armada supporting the invasion, and dispatched three powerful task forces from the China Sea and the home islands to the invasion area for a decisive battle. The ensuing battle lasted from Oct. 22 to 27, and resulted in a complete defeat for the Japanese. Losses to the Japanese fleet, inflicted chiefly by U.S. carrier-borne aircraft, included two battleships, four aircraft carriers, six heavy cruisers, three light cruisers, and numerous lesser vessels, in addition to various craft severely damaged and possibly sunk. In these desperately fought naval battles the Japanese initiated their *kamikaze* ("divine wind") attacks, in which Japanese pilots deliberately crashed their planes on American ships. American losses were one light carrier, two escort carriers, two destroyers, one destroyer escort, and a few smaller vessels.

On Jan. 1, 1945, the Luzon attack force sailed from Leyte to seize Lingayen as a base for the attack on Manila. Heavy fighter cover destroyed most of the 120 aircraft launched by the Japanese against the force, but on Jan. 4 the Japanese commenced a series of kamikaze attacks, damaging many U.S. ships. Finally on Jan. 9, MacArthur's forces landed on the beaches of Lingayen Gulf, on the island of Luzon. By this time the Japanese aircraft on Luzon had been destroyed and their ground forces could not be reinforced. The latter continued to dispute the American advance, however, until they were almost totally destroyed. Additional U.S. forces were subsequently landed at points north and south of Manila. By early February, units of the

Sixth Army were moving on Manila from every direction, while the Japanese organized a desperate defense of the city, 20,000 naval troops converting it into a veritable fortress. After bloody house-to-house fighting, resulting in considerable destruction, organized resistance was declared ended on March 4, and Manila was again in American hands.

The fortress of Corregidor, key to Manila harbor, was recaptured by U.S. infantry and parachute troops after a grim battle lasting from Feb. 16 to March 2. Japanese garrisons on the scores of other islands in the Philippine archipelago were systematically attacked and forced to surrender during the ensuing months. The completion of the liberation of the Philippines was announced by MacArthur on July 5.

American Submarine Operations in the Pacific. In addition to supporting the U.S. fleets in major battles, U.S. submarines conducted unremitting attrition on the Japanese merchant marine. About one third of the Japanese combatant ships sunk and two thirds of the Japanese merchant tonnage destroyed were the work of U.S. submarines. The latter, although hindered by defective torpedoes in the early days of the war, were taking a heavy toll of Japanese shipping by 1943. The Japanese were unprepared either for aggressive use of their own submarines or for the protection of their vital merchant marine from attack by U.S. submarines, leading to a critical loss of supplies and to an inability to transport military forces among the various combat zones. By the end of the war the Japanese merchant marine had been destroyed, and only a few wooden ships were left in the Inland Sea.

Allied Offensive in Southeast Asia. One of the principal objectives of the Allies in Southeast Asia was to furnish increased quantities of supplies and war materials to the embattled Chinese, a project rendered difficult by the Japanese conquest of the Burma Road early in the war. To thwart Japanese control of the supply route to China, the U.S. Air Transport Command established an aerial route over "The Hump", that is, over the Himalayas from India to the interior of China. Additional means were essential, however, to fill the vast needs of the Chinese armies, and the Allies therefore began a drive to clear Burma of the Japanese.

Early in 1944, before the Allied attack could be launched, the Japanese initiated an invasion of India from Burma. British and Indian troops met the invaders on the Imphal plain, and in a series of great battles routed the Japanese and forced them to retreat into Burma. In March a two-



Marines raise the American flag on Iwo Jima after taking the island from the Japanese in a costly month-long battle in 1945.
UPI

pronged Allied advance was begun into central Burma. The clearing of the Burma Road proceeded steadily until Jan. 20, 1945, when the road was reopened to Allied traffic. Mandalay was taken in March and Rangoon in May. The victory at Rangoon meant the realization of the Allied objectives in Burma: the Japanese occupation forces had been thoroughly disorganized and were no longer a dangerous factor, and the supply route to China was again open.

Battles for Iwo Jima and Okinawa. While the troops of the Southeast Asia Command were forging ahead against the Japanese in Burma, the U.S. forces in the Pacific, having consolidated their positions in the Philippines, continued their island-hopping approach to Japan in preparation for the invasion of the enemy home islands. On Feb. 19, 1945, the V Amphibious Corps of the U.S. Marine Corps, sup-

ported by the U.S. Fifth Fleet, stormed the beaches on the little island of Iwo Jima (q.v.), about 400 miles s. of Japan. Possession of this island was deemed important because of its potential value as an emergency landing base for the aerial bombardment of Japan by the dreaded B-29 superfortress bombers, most powerful of the U.S. Air Force weapons. A preinvasion bombardment by U.S. naval and air units had destroyed some of the enemy defenses, but the island was so well fortified that its inland defenses remained largely intact. The fighting that ensued after the landings was costlier to the U.S. forces than any that had preceded it, but the defenders were able to do no more than delay the advance of the invading force. The

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battle continued from Feb. 19 to March 17, when the last vestige of resistance was eliminated. American losses were 6891 killed and 18,070 wounded, comprising an unusually high percentage of the forces involved. The Japanese lost about 21,000 killed and 1259 prisoners. After the conquest of Iwo, the U.S. air offensive against Japan was accelerated with large forces of B-29's ranging throughout the Japanese archipelago and wreaking heavy damage on industrial and military installations.

The next island objective of the U.S. Pacific forces was Okinawa (q.v.) one of the Ryukyu Islands, only about 350 mi. from Japan. The invasion was carried out by the Fifth Fleet under Admiral Raymond Ames Spruance (1886–1969) and the U.S. Tenth Army, commanded by Lieutenant General Simon Bolivar Buckner, Jr. (1886–1945). About 1400 vessels, ranging from battleships to small landing craft, were used in the Okinawa invasion, the largest amphibious operation up to that time in the Pacific. On March 26, the 77th Division was put ashore on Kerama Retto, 20 miles w. of the southern end of Okinawa. A defending force of 900 Japanese was quickly overcome, and squadrons of Marine Corps fighter planes were based at airfields on the island, from which they could cover the invasion of the main island.

The landings on Okinawa began on April 1, the troops going ashore on the western coast of the island, north of Naha, the principal city. Little initial resistance was encountered, and two important airfields were taken on the first day, during which 50,000 troops were landed on the beaches. The Japanese defending force was composed of about 80,000 regulars, well equipped with heavy artillery, and an indeterminate number (perhaps 50,000) of Okinawan labor troops. Most of this force was concentrated in the southern portion of the island, where landings could not be made behind them and where the excellent fortifications and the terrain afforded the opportunity for a stubborn defense. The northern half of the island was quickly cleared by U.S. Marine elements of the Tenth Army. Progress was considerably slower against the formidable Japanese strongholds in the south. While the Japanese army was carrying out its defense, a Japanese naval force launched a massed kamikaze attack on U.S. naval elements defending Okinawa from air attack from Japan. Most of the Japanese force was destroyed in the subsequent engagement. Early in May the Japanese launched a determined counterattack in the south, accompanied by two amphibious attacks by about 2000 men each on the flanks of

the U.S. line. General Buckner quickly shifted his forces to meet this threat, and the counterattack was repulsed.

By the middle of May the U.S. forces were in position for the final assault on the Japanese defense line in the south, but just at this time the island was stricken by a great wind and rain storm, bogging down all heavy equipment and transportation. The weather did not improve until early in June, and the attack was immediately launched, with armored units in the lead. On June 19 Marine Corps elements reached the southern coast of the island, while infantry units captured the command post of the Japanese Thirty-Second Army, the main defending force. Okinawa was declared secured on June 22, although small groups of enemy soldiers continued to fight for some time. General Buckner did not live to see the victory; he was killed by artillery fire on June 18, while in a forward position with the assault infantry.

During the ground fighting on Okinawa, the supporting naval forces were repeatedly attacked by Japanese suicide boats and over 3000 kamikaze planes in addition to hundreds of attacks by conventional dive bombers and torpedo planes. More than 200 vessels of all types were hit and damaged by the kamikaze planes; 30 vessels were sunk, including 12 destroyers. In the entire campaign the Japanese navy lost almost 4000 planes in the air and 800 on the ground; the Japanese army lost about 2600 more. Total Japanese casualties were 110,071 killed and 7401 taken prisoner (with some thousands left sealed in underground bunkers); the U.S. Army, Navy, and Marine losses on the ground totaled 12,281 killed, 31,398 wounded, and 238 missing.

Victory Over Japan. In the latter part of May and early June, General MacArthur's forces invaded Borneo, in the Netherlands East Indies. This operation was aimed at denying the Japanese access to their conquered territories in the East Indian archipelago. The landings were effected by the 9th Australian Division, which was transported to its destination by a naval task force consisting of U.S. and Australian vessels. The small island of Tarakan, off the Borneo coast, and Brunei Bay, in northwestern Borneo, were the target areas of the invasion. The former objective was quickly secured, and in Borneo the Australians rapidly cleared an area sufficiently large to permit the establishment of air and naval bases, affording the Allies greater coverage of the Asian coast from Singapore to Shanghai.

Meanwhile, the Allied aerial offensive against



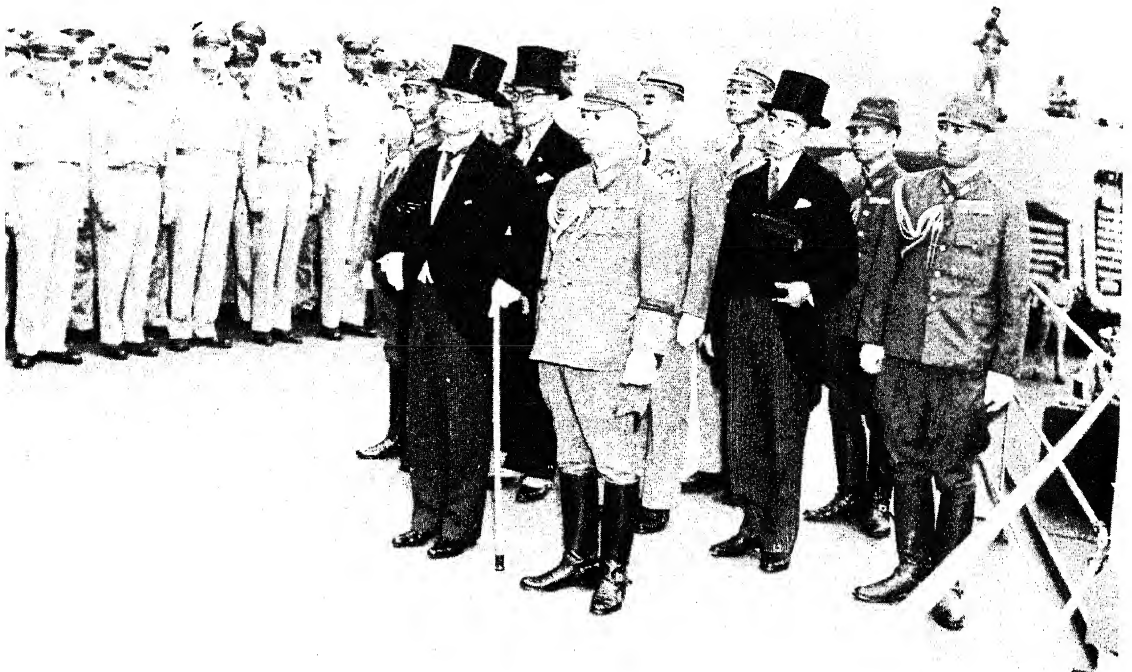
The city of Hiroshima lies in ruins after the first use of the atomic bomb in warfare, Aug. 6, 1945. UPI

Japan attained new heights of destructive fury. Great areas in the industrial cities of Tokyo, Nagoya, Osaka, and Kobe, as well as other militarily important targets, were ravaged by massed flights of B-29 bombers. On July 26, representatives of the U.S., Great Britain, and China met at Potsdam, in conquered Germany, and issued an ultimatum, the Potsdam Declaration, calling on Japan for unconditional surrender; see POTSDAM CONFERENCE. Should the Japanese reject this demand, the Allies grimly threatened her with "utter destruction", a threat the Superfortresses had already begun to effectuate.

On Aug. 6, 1945, occurred an event fraught with immense implications not only for the future course of the war, but for the fate of all mankind. On that date the atomic bomb was used as a weapon of war for the first time in history. The bomb was dropped from a B-29 bomber upon the Japanese city of Hiroshima (q.v.). This most destructive of all weapons had more power than 20,000 tons of TNT, and more than 2000 times the power of the largest bomb previously used in warfare. By the release of this single bomb, about 60 percent of the city of Hiroshima was destroyed. An area of about 2½ mi.

in diameter was completely flattened. An estimated total of 130,000 persons were killed, injured, or missing, more than 58,000 were killed outright, and many others died subsequently of wounds, burns, and shock. The long-term effects on the health of the survivors of the atomic radiation released in the explosion were to become the subject of careful study by scientists for years afterward. Humanity had created a weapon literally capable of destroying civilization; in the postwar period, the international control of atomic energy and the illegalization of its use for war purposes were among the most crucial subjects of debate in the United Nations; see NUCLEAR WEAPONS; UNITED NATIONS; *International Control of Atomic Energy*.

The decision to use the atomic bomb on Japan was one of the most controversial of the war. Although a Presidential commission of scientists and other authorities recommended immediate use of the new weapon as a means of averting a costly Allied invasion of Japan, other persons argued against its use. They felt that Japan should be fully warned of the destructive-



Above: Japanese officials aboard the U.S.S. Missouri to participate in surrender ceremonies, Sept. 2, 1945. Below: General Douglas MacArthur, Allied supreme commander in the Southwest Pacific, briefs newsmen on his arrival at an airport near Tokyo where he established his headquarters as supreme commander for the Allied powers in Japan.

UPI



U.S. Army

Spontaneous victory celebrations broke out in cities and towns across the U.S. at news of the surrender of Japan and the end of World War II.

Wide World



ness of the bomb, even to the extent of dropping the weapon on an unoccupied area. In addition, Japan had already made tentative movements toward surrender through the Soviet Union, leading several historians to question the necessity of the unparalleled act of war represented by the use of nuclear weapons.

Two days after the atomic attack on Hiroshima, the Soviet Union declared war on Japan and launched a powerful offensive against the Japanese armies in Manchuria. The entry of the Soviet Union into the war against Japan was in accord with the terms of a secret agreement concluded by President Roosevelt, Prime Minister Churchill, and Marshal Stalin at a conference at Yalta, in the Crimea, in February, 1945; see YALTA CONFERENCE. At that meeting, the Soviet leader had agreed to a declaration of war against Japan by the U.S.S.R. exactly three months after the surrender of Germany, and this pledge was fulfilled. The Soviet Far Eastern Army, well equipped with armor and artillery, moved forward rapidly against the Japanese in Manchuria, driving them southward and clearing many important areas.

Meanwhile, the Allies having received no reply to their demand for unconditional surrender by the Japanese, and while the Japanese government was considering the effect of the

unprecedented attack on Hiroshima, a second atomic bomb was dropped on Nagasaki (q.v.) on Aug. 9. The destructive effects of the second bomb rivaled those of the first. On the following day the Japanese government announced that it would accept the Potsdam terms, providing that they would not be construed to "comprise any demand which prejudices the prerogatives of His Majesty as a Sovereign Ruler". The Allies, who believed that they could best control and disarm the large bodies of Japanese troops on the Asiatic mainland and in the outlying islands through the emperor, issued a statement in reply declaring that "from the moment of surrender the authority of the Emperor and the Japanese Government to rule the state shall be subject to the Supreme Allied Commander, who shall take such steps as he deems proper to effectuate the surrender terms". The Japanese acceptance of this declaration and of the Potsdam ultimatum was announced on Aug. 14 in an imperial rescript. Except for the signing of a formal instrument of surrender and communication of the emperor's decision to the Japanese troops outside the home islands, the war was ended.

General MacArthur was appointed supreme commander for the Allied powers and immediately set about making the arrangements for the

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formal surrender ceremonies. The instrument of surrender was signed on Sept. 2 aboard the U.S. battleship *Missouri*, which had entered and anchored in Tokyo Bay, by a deputation headed by the Japanese foreign minister Mamoru Shigemitsu (1887–1957). In accordance with the terms of the surrender document, the emperor at once issued a proclamation instructing his subjects to cease hostilities, lay down their arms, and carry out the terms of the surrender. In obedience to these instructions, Japanese troops in China, Formosa, Manchuria, and many islands in the Pacific ceased fighting and submitted to the directions of Allied commanders. The date of the signing of the surrender, Sept. 2, was officially designated by the Allies as V-J (Victory over Japan) Day. Thus, the costliest and most terrible war in all history, which had involved virtually every nation in the world, had at last come to an end.

THE COST OF THE WAR

No mere summary of the statistics relating to the loss of lives and property in World War II can possibly indicate the enormity of the tragedy. The untold cost in suffering and sorrow, in broken homes and orphaned children; the travail of whole peoples rendered homeless; the years of imprisonment and privation undergone by millions of prisoners of war and inmates of concentration camps; the hardships borne by civilian populations because of curtailed production of everyday necessities; and the rigors of military service and combat suffered by the members of the armed forces of all the nations engaged in the war—all of these factors are not susceptible of statistical measurement or tabulation. The following compilation of war costs must be considered as merely a fragmentary indication of the ravages of this unparalleled struggle.

Allied Casualties. Besides the 291,557 battle deaths shown in the accompanying table, casualties suffered by the U.S. armed forces during World War II included 113,842 deaths due to other causes. In addition, 1345 American merchant seamen died as the result of enemy action, 37 died in prisoner-of-war camps, and 4780 were reported missing.

Few of the powers allied with the U.S. during World War II have issued definitive data regarding battle casualties. Most of the figures cited in the following are official or semiofficial estimates. The casualties of the Soviet Union totaled about 20,127,000, outnumbering by far those of any other Ally. More than 14,000,000 members of the Soviet armed forces were wounded in action; the remainder of the casual-

ties comprise battle deaths and deaths from other causes. Ranking next to the Soviet Union in casualties is China, with some 1,324,500 killed in action and about 1,762,000 wounded. Poland suffered about 1,194,000 casualties, including 664,000 killed in action and 530,000 wounded. Deaths from all causes in the British armed forces totaled 357,116, and 369,267 were wounded. French military losses included 201,568 killed in action, 261,577 dead from other causes, and about 400,000 wounded. Other Allied nations that suffered substantial military casualties in the war include Yugoslavia (730,000), Australia (207,840), India (96,475), Canada (85,557), and Greece (64,314).

U.S. CASUALTIES IN WORLD WAR II

Branch of Service	Personnel Engaged	Battle Deaths	Wounds Not Mortal
Army ¹	11,260,000	234,874	565,861
Navy ²	4,183,466	36,950	37,778
Marine Corps	669,100	19,733	67,207
Total	16,112,566	291,557	670,846

¹ Includes Army Air Forces.

² Includes Coast Guard.

Source: *Statistical Abstract of the United States*

Axis Casualties. Of the three major Axis powers, Germany suffered the highest number of casualties. A total of about 3,250,000 members of the German armed forces died in action or from other causes, and some 7,250,000 were wounded. About 3,350,000 German civilians were killed. The Japanese armed services lost approximately 1,270,000 dead and 4,616,000 wounded. About 85,000 Japanese soldiers and sailors were reported missing. The Allied air raids on Japan killed 241,309 civilians and injured 313,041. Austria lost about 280,000 men in battle, and some 350,100 were wounded. Italian military casualties totaled about 149,500 deaths in battle or from other causes, 66,700 wounded, and 135,000 missing. Other Axis nations that suffered severe military and civilian losses in killed and wounded were Rumania (350,000) and Hungary (236,750).

Financial Costs. For a number of reasons, an exact statistical compilation of the financial costs of the war is impossible. Such factors as loss of irreplaceable natural resources and of normal production and trade are not accurately measurable. The computation of financial costs, moreover, suffers from the difficulty of a lack of any consistent means of indicating precisely when such costs may be considered as having begun, and when they stopped. In converting estimates of the costs borne by the various countries into a single currency standard, in this case that of the U.S., the differing methods of

compiling such statistics in the several countries, the varying rates of conversion into U.S. currency, and numerous other variables must be taken into account. Considering all of these difficulties, and making due allowance for probable error, the following is an approximation of the monetary costs borne by several of the leading nations involved in the war.

The U.S. is estimated to have expended from \$317,600,000,000 to \$341,491,000,000, of which about \$48,000,000,000 was lend-lease. The estimated cost of the war to the Soviet Union was \$192,000,000,000; to Great Britain, \$120,000,000,000; to Germany, \$272,000,000,000; to Italy, \$94,000,000,000; and to Japan, \$56,000,000,000.

THE NATIONS INVOLVED IN WORLD WAR II

Albania Declared war on United States	Dec. 17, 1941	Costa Rica Declared war on Japan, Germany, and Italy	Dec. 8, 1941 Dec. 11, 1941
Argentina Severed diplomatic relations with Bulgaria, Hungary, Rumania, and the Axis satellite government of France Declared war on Germany and Japan	Feb. 4, 1944 March 27, 1945	Croatia As an Axis-created puppet, declared war on U.S.	Dec. 14, 1941
Australia Declared war on Germany, Italy, Finland, Hungary, Rumania, Japan, Bulgaria, and Thailand	Sept. 3, 1939 June 11, 1940 Dec. 7, 1941 Dec. 8, 1941 Jan. 6, 1942 March 2, 1942	Cuba Declared war on Japan, Germany, and Italy Severed relations with France	Dec. 9, 1941 Dec. 11, 1941 Nov. 9, 1942
Austria Became involved in the war as a part of Germany, following its annexation by the latter in 1938		Czechoslovakia Czech government in exile declared war on all nations then at war with U.S., Great Britain, and Soviet Union	Dec. 16, 1941
Belgium Invaded by Germany Belgian government in exile declared war on Italy, and severed relations with Rumania, Bulgaria, and Finland Declared war on Japan	May 10, 1940 Nov. 23, 1940 Feb. 12, 1941 March 5, 1941 June 29, 1941 Dec. 20, 1941	Denmark Invaded by Germany Under German occupation, severed relations with Netherlands, Belgium, Norway, and Soviet Union After surrender of German troops in Denmark, severed relations with Japan	April 8, 1940 May 10, 1940 July 15, 1940 June 26, 1941 May 17, 1945
Bolivia Declared war on Germany, Italy, Japan, and other Axis nations	Dec. 4, 1943	Dominican Republic Declared war on Japan, Germany, and Italy Severed relations with France	Dec. 8, 1941 Dec. 11, 1941 Nov. 11, 1942
Brazil Declared war on Germany, Italy, and Japan	Aug. 22, 1942 June 6, 1945	Ecuador Severed relations with Germany, Italy, and Japan	Jan. 29, 1942
Bulgaria Severed relations with Belgium, Netherlands, and Poland Declared war on Greece, Hungary, Yugoslavia, Soviet Union, U.S. and Great Britain Declared its neutrality Declared war on Germany Severed relations with Japan	March 4, 1941 April 24, 1941 June 22, 1941 Dec. 12, 1941 Aug. 26, 1944 Sept. 7, 1944 Nov. 10, 1944	Egypt Severed relations with Italy, Hungary, Rumania, Bulgaria, Finland, and France Declared war on Germany and Japan	June 12, 1940 Dec. 15, 1941 Jan. 5, 1942 Jan. 6, 1942 Feb. 24, 1945
Burma Declared war against U.S. and Great Britain	Aug. 1, 1943	Ethiopia Declared war on Germany, Italy, and Japan	Dec. 14, 1942
Canada Declared war on Germany, Italy, Finland, Hungary, Rumania, and Japan Severed relations with France	Sept. 10, 1939 June 11, 1940 Dec. 7, 1941 Nov. 9, 1942	Finland Invaded by Soviet Union Concluded peace treaty with U.S.S.R. Declared war on Soviet Union Declared war on Great Britain Severed relations with Hungary, Croatia, Slovakia, and Japan Declared war on Germany	Nov. 30, 1939 March 12, 1940 June 25, 1941 Dec. 6, 1941 Sept. 19, 1944 Sept. 22, 1944 March 3, 1945
Chile Severed relations with Germany, Italy, Bulgaria, Hungary, Rumania, and France Declared war on Japan	Jan. 20, 1943 May 18, 1943 April 11, 1945	France Declared war on Germany and Italy Capitulated to Germany Under German domination, severed relations with Great Britain, Belgium, Netherlands, Norway, Poland, Soviet Union, Yugoslavia, Greece, U.S., and Peru The Free French National Council, formed in exile on Sept. 23, 1941, declared war on Germany	Sept. 3, 1939 June 11, 1940 June 22, 1940 July 5, 1940 Sept. 5, 1940 Sept. 23, 1940 June 30, 1941 Aug. 22, 1941 June 30, 1942 Nov. 8, 1942 Jan. 26, 1943 Dec. 8, 1941
China Declared war on Germany, Italy, and Japan Severed relations with France	Dec. 9, 1941 Aug. 1, 1943		
Colombia Severed relations with Japan, Italy, and France Declared war on Germany	Dec. 8, 1941 Dec. 19, 1941 Nov. 26, 1942 Nov. 26, 1943		

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NATIONS INVOLVED IN WORLD WAR II (Continued)

Germany Invaded Poland, Denmark, Norway, Netherlands, Belgium, France, Greece, Yugoslavia, and Soviet Union Declared war on U.S.	Sept. 1, 1939 April 8, 1940 May 10, 1940 April 6, 1941 June 22, 1941 Dec. 11, 1941	Mexico Severed relations with Hungary and Bulgaria Declared war on Germany, Italy, and Japan Severed relations with France	Dec. 19, 1941 Dec. 20, 1941 May 22, 1942 Nov. 9, 1942
Great Britain Declared war on Germany, Italy, Finland, Hungary, Rumania, Japan, Bulgaria, and Thailand	Sept. 3, 1939 June 11, 1940 Dec. 7, 1941 Dec. 13, 1941 Jan. 25, 1942	Mongolian People's Republic Declared war on Japan	Aug. 9, 1945
Greece Invaded by Italy and Germany Severed relations with Bulgaria, Hungary, and Japan	Oct. 28, 1940 April 6, 1941 April 7, 1941 Dec. 7, 1941	Netherlands Invaded by Germany Dutch government in exile severed relations with Denmark, Rumania, Bulgaria, Hungary, and Finland; and declared war on Japan and Italy Netherlands East Indies invaded by Japan	May 10, 1940 July 15, 1940 Feb. 11, 1941 March 9, 1941 April 9, 1941 June 28, 1941 Dec. 8, 1941 Dec. 11, 1941 Jan. 11, 1942
Guatemala Declared war on Japan, Germany, and Italy Severed relations with France	Dec. 9, 1941 Dec. 11, 1941 Nov. 12, 1942	New Zealand Declared war on Germany, Italy, Finland, Hungary, Rumania, Japan, Bulgaria, and Thailand Severed relations with France	Sept. 3, 1939 June 11, 1940 Dec. 7, 1941 Dec. 8, 1941 Dec. 13, 1941 Jan. 25, 1942 Nov. 17, 1942
Haiti Declared war on Japan, Germany, Italy, Bulgaria, Hungary, and Rumania Severed relations with France	Dec. 8, 1941 Dec. 12, 1941 Dec. 24, 1941 Nov. 10, 1942	Nicaragua Severed relations with France Declared war on Japan, Germany, Italy, Bulgaria, Hungary, and Rumania	Dec. 7, 1941 Dec. 8, 1941 Dec. 11, 1941 Dec. 19, 1941
Honduras Declared war on Japan, Germany, and Italy Severed relations with France	Dec. 8, 1941 Dec. 13, 1941 Nov. 13, 1942	Norway Invaded by Germany Norwegian government in exile severed relations with Italy, Rumania, Finland, and Japan	April 8, 1940 June 13, 1940 Feb. 21, 1941 Dec. 7, 1941 Dec. 9, 1941
Hungary Severed relations with Greece Declared war on Soviet Union and U.S. Severed relations with Brazil and Uruguay Declared war on Rumania After signing armistice with Allies, de- clared war on Germany	June 24, 1941 June 27, 1941 Dec. 13, 1941 May 2, 1942 May 4, 1942 Sept. 7, 1944 Jan. 20, 1945	Panama Declared war on Japan, Germany, and Italy Severed relations with France	Dec. 7, 1941 Dec. 12, 1941 Nov. 13, 1942
Iceland Occupied by British armed forces in 1940 and by U.S. forces	July 7, 1941	Paraguay Severed relations with Italy Declared war on Germany and Japan	Jan. 28, 1942 Feb. 7, 1945
India Declared war on Finland, Hungary, and Rumania	Dec. 7, 1941	Peru Severed relations with France Declared war on Germany and Japan	Jan. 26, 1943 Feb. 12, 1945
Iran Occupied by Great Britain and Soviet Union jointly Severed relations with Bulgaria, Hungary, Italy, Rumania, and France Declared war on Germany and Japan	Aug. 25, 1941 Sept. 16, 1941 Feb. 5, 1942 Sept. 9, 1943 March 1, 1945	Poland Invaded by Germany Invaded by Soviet Union Polish government in exile severed relations with Rumania, Italy, Hungary, and Bulgaria Declared war on Japan	Sept. 1, 1939 Sept. 17, 1939 Nov. 5, 1940 Nov. 13, 1940 Jan. 1, 1941 March 5, 1941 Dec. 11, 1941
Iraq Severed relations with France Declared war on Germany, Italy, and Japan	Nov. 16, 1941 Jan. 17, 1943	Portugal Gave Great Britain antisubmarine bases in Azores islands Severed relations with Germany	Oct. 12, 1943 May 6, 1945
Italy Declared war on France and Great Britain Invaded Greece Declared war on Yugoslavia, Soviet Union, U.S., Cuba, and Guatemala After unconditional surrender to Allies on Sept. 8, 1943, declared war on Germany and Japan	June 10, 1940 Oct. 28, 1940 April 6, 1941 June 22, 1941 Dec. 11, 1941 Dec. 13, 1941 Oct. 13, 1943 July 14, 1945	Rumania Invaded Soviet Union Severed relations with Greece Declared war on Great Britain, U.S., Nicaragua, and Haiti Severed relations with Brazil Accepted armistice terms imposed by Allies Declared war against Germany, Hungary, and Japan	June 22, 1941 June 24, 1941 Dec. 6, 1941 Dec. 12, 1941 Dec. 19, 1941 Dec. 24, 1941 March 6, 1942 Aug. 23, 1944 Aug. 25, 1944 Sept. 7, 1944 March 7, 1945
Japan Invaded French Indochina Severed relations with Poland Declared war on U.S., Great Britain, Aus- tralia, Canada, New Zealand, Union of South Africa, and the Netherlands	Sept. 22, 1940 Oct. 5, 1941 Dec. 7, 1941 Jan. 11, 1942	Salvador Declared war on Japan, Germany, and Italy Severed relations with France	Dec. 8, 1941 Dec. 12, 1941 Nov. 13, 1942
Lebanon Declared war on Germany and Japan	Feb. 27, 1945	San Marino Declared war on Germany	Sept. 21, 1944
Liberia Declared war on Germany and Japan	Jan. 27, 1944	Saudi Arabia Declared war on Germany and Japan	March 1, 1945
Luxembourg Invaded by Germany Severed relations with France	May 10, 1940 Sept. 5, 1940	Slovakia As an Axis-created puppet state, severed relations with Soviet Union and declared war on U.S. and Great Britain	June 22, 1941 Dec. 12, 1941
Manchukuo As a Japanese puppet state, declared war on U.S.	Dec. 8, 1941		

NATIONS INVOLVED IN WORLD WAR II (Continued)

Spain Severed relations with Japan	April 11, 1945	Invaded Rumania, Poland, Bulgaria, Yugoslavia (with agreement with antifascist partisans under Marshal Tito), and Hungary in 1944; and Austria, Czechoslovakia, and Germany in 1945	
Sweden Severed relations with Germany	May 7, 1945	Declared war on Japan	Aug. 8, 1945
Syria Invaded by Great Britain Declared war on Germany and Japan	June 8, 1941 Feb. 26, 1945	United States Declared war on Japan, Germany, Italy, Bulgaria, Hungary, and Rumania Severed relations with Finland	Dec. 8, 1941 Dec. 11, 1941 June 5, 1942 June 30, 1944
Thailand Declared war on U.S. and Great Britain Voided war declaration	Jan. 25, 1942 Aug. 16, 1945	Uruguay Severed relations with Italy and France Declared war on Germany and Japan	Jan. 25, 1942 May 12, 1943 Feb. 15, 1945
Turkey Declared war on Germany and Japan	Feb. 23, 1945	Venezuela Severed relations with Italy and France Declared war on Germany and Japan	Dec. 31, 1941 Nov. 27, 1942 Feb. 15, 1945
Union of South Africa Declared war on Germany, Italy, Finland, Hungary, Japan, Rumania, Bulgaria, and Thailand Severed relations with France	Sept. 6, 1939 June 11, 1940 Dec. 8, 1941 Dec. 13, 1941 Jan. 25, 1942 April 23, 1942	Yugoslavia Invaded by Germany and Hungary Yugoslav government in exile severed relations with Finland, and declared war on Japan	April 6, 1941 April 10, 1941 Aug. 22, 1941 Dec. 7, 1941
Union of Soviet Socialist Republics Invaded Poland Invaded Finland Concluded peace with Finland Invaded by Germany and Rumania Declared war on Bulgaria	Sept. 17, 1939 Nov. 30, 1939 March 12, 1940 June 22, 1941 Sept. 5, 1944		

PEACE TREATIES

Peace treaties signed in Paris, Feb. 10, 1947

With	By
Italy	U.S., Great Britain, U.S.S.R., China, France, Australia, Belgium, Brazil, Canada, Czechoslovakia, Ethiopia, Greece, India, Netherlands, New Zealand, Poland, Ukrainian S.S.R., Union of South Africa, White Russian S.S.R., and Yugoslavia.
Rumania	U.S.S.R., Great Britain, U.S., Australia, Canada, Czechoslovakia, India, New Zealand, Ukrainian S.S.R., Union of South Africa, and White Russian S.S.R.
Bulgaria	Some signatories, with the exception of Canada, as with Rumania, and with the addition of Greece and Yugoslavia.
Hungary	Same signatories as with Rumania, and with the addition of Yugoslavia.
Finland	Same signatories as with Rumania, with the exception of the U.S.

Peace treaty signed in San Francisco, Sept. 8, 1951

With	By
Japan	Argentina, Australia, Belgium, Bolivia, Brazil, Cambodia, Canada, Ceylon, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, France, Great Britain, Greece, Guatemala, Haiti, Honduras, Indonesia, Iran, Iraq, Laos, Lebanon, Liberia, Luxembourg, Mexico, Netherlands, New Zealand, Nicaragua, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Saudi Arabia, South Africa, Syria, Turkey, U.S., Uruguay, Venezuela, and Vietnam.

Peace (state) treaty signed in Vienna, May 15, 1955

With	By
Austria	France, Great Britain, U.S.S.R., and U.S.

WORM. See ANNELIDA; FLATWORM; NEMATODES.
WORMS (anc. *Borbetomagus*; later *Augusta Vangionum* and *Wormatia*), city and port of West Germany, in Rhineland-Palatinate State, on the w. bank of the Rhine R., about 10 miles N.W. of Mannheim. The city is a railroad junction. The surrounding region is celebrated for its vineyards; Liebfraumilch is produced in Worms. Important manufactures include machinery, worsteds, chemicals, and furniture. The city contains many points of interest, including the remains of medieval walls and fortifications. Prominent among the noteworthy edifices is the 12th-century Romanesque cathedral, with an ornate Gothic portal dating from the 15th century. The former Church of Saint Paul, now a museum, also dates from the 12th century. Additional landmarks include the 15th-century Church of Our Lady, the Church of Saint Martin, and an impressive 19th-century monument to the German religious reformer Martin Luther (q.v.).

Early History. The site of Worms was occupied by the chief town of the Vangiones, one of the Germanic tribes. The Vangiones were eventually

expelled from their town by the Romans, who called it Borbetomagus. On the site the Romans built a fort about 14 B.C. In 412 A.D. the Romans transferred control of the town, then known as Augusta Vangionum, to the Burgundians, another Germanic tribe (see BURGUNDY), who made it the capital of their kingdom. Both the kingdom and capital were destroyed in 436 by invading Huns, led by their king, Attila (q.v.). A number of heroic legends that originated in the Burgundians' defense of their possessions were incorporated, during the 12th century, in the *Nibelungenlied* (q.v.), the greatest of the German national epics.

In 486 Clovis I (q.v.), ruler of the Salian Franks (q.v.), constructed a new town on the site of the Burgundian capital and renamed it Wormatia. Worms, as the town soon became known, was established shortly as an episcopal see. During the 10th and 11th centuries, the bishops of Worms acquired considerable political power. Popular dissatisfaction over this state of affairs brought the city into alliance with the Holy Roman emperors in their struggle with the Church, and early in the 13th century Worms



The west portal of the cathedral at Worms.

German Tourist Information Office

became a free imperial city. Meanwhile, in 1122, Pope Callistus II and Henry V (qq.v.), King of Germany and Holy Roman Emperor, concluded at Worms the famous agreement known in history as the Concordat of Worms. By the terms of this agreement, investiture (q.v.) of bishops and abbots, a right long claimed by the emperors, was thereafter reserved to the papacy.

Since the Reformation. In the Holy Roman Empire (q.v.), Worms was often the meeting place of the imperial Diets (see DIET). The most famous of these was the so-called Diet of Worms, convoked in 1521. To this Diet, Charles V (q.v.), Holy Roman Emperor, summoned Luther, at that time under threat of excommunication (q.v.) because of his teachings. Luther, given a safe-conduct to Worms and favored by many in the assembly, refused to retract his teachings when asked, and even argued his beliefs with several Catholic theologians present at the Diet. He was allowed to leave Worms unmolested; but a few weeks later, Charles V issued an imperial edict that outlawed Luther and his followers; see REFORMATION: *National Movements*. In 1525, the people of Worms adopted Luther's teachings. As a Protestant stronghold, the city was subjected to severe reprisals during the Thirty Years' War (q.v.). Worms was almost

totally destroyed by a French army in 1689, during the War of the League of Augsburg. In 1801, during the Napoleonic Wars (q.v.), it was deprived of its status as a free city and annexed by France. By a decision of the Congress of Vienna (1815), which imposed peace terms on France after the Napoleonic Wars, Worms was awarded to the German grand duchy of Hesse-Darmstadt; see HESSE; VIENNA, CONGRESS OF. The city sustained heavy damage during World War II. In 1947 it became part of the newly created State of Rhineland-Palatinate. Pop. (1971 est.) 76,900.

WORMWOOD, perennial herb or shrubby plant, *Artemisia absinthium*, in the Composite family, Compositae. Native to Europe, it was cultivated in the gardens of eastern North America, where it now grows wild by the roadsides. It has an erect stem from 2 to 4 ft. high and small, yellow, hemispherical flower heads. The leaves and flowers contain an aromatic, bitter, toxic substance used since ancient times in the manufacture of absinthe (q.v.). The name "wormwood" is sometimes applied to the entire genus *Artemisia*. See PLANTS, POISONOUS; VERMOUTH.

WOUK, Herman (1915–), American writer, born in New York City, and educated at Columbia University. During World War II Wouk

served in the United States Navy in the Pacific Ocean; this experience provided the background for his war novel *The Caine Mutiny* (1951; Pulitzer Prize, 1952). Several million copies of the novel were sold; it was made into a popular motion picture (1954); and the author adapted an episode of the novel into a play, *The Caine Mutiny Court Martial* (1954).

Among Wouk's other novels are *Marjorie Morningstar* (1955), a successful romance of big-city Jewish life; *Youngblood Hawke* (1962), a picture of the life and loves of an American novelist; *Don't Stop the Carnival* (1965), detailing the misadventures of a hotel owner in the West Indies; and *The Winds of War* (1971), an account of a naval officer and his family during World War II.

WOUND, in pathology, any break in the external or internal surfaces of the body involving a separation of tissue, and caused by external injury or force. Wounds are classified as incised, or cut, if they are produced by a sharp instrument or object; puncture, if the instrument is pointed and narrow; lacerated, if accompanied by a tearing of the tissue; contused, if a substantial amount of tissue is bruised; penetrating, if the wound enters a body cavity; perforating, if the wound passes completely through a part of the body; and subcutaneous, if it involves deep destruction of tissue with a relatively small opening, or none at all, in the surface. Septic, or infected, wounds are those in which the area is contaminated by bacteria (q.v.) which can cause suppuration or shedding of tissue. Wounds heal by the formation of granulation and fibrous tissue, constituting what is later known as a scar; see **SKIN**. The danger in wounds includes the possibility of a ruptured blood vessel (see **CIRCULATION OF THE BLOOD**), causing hemorrhage, and the possibility of introducing foreign material or pathogenic bacteria, which can cause infection. Proper cleaning of a wound and the removal of dead tissue are important; antibiotics are effective in combating infection; see **ANTIBIOTIC**. When necessary, plasma or plasma substitutes are administered for shock; see **BLOOD**; **BLOOD TRANSFUSION**; **FIRST AID**; **TETANUS**.

WOUNDED KNEE, village in South Dakota, on Wounded Knee Creek, about 70 mi. S.E. of Rapid City, located on the Pine Ridge Indian Reservation of the Oglala Sioux. The locality was the scene of two confrontations between the Federal government and the Oglala Sioux. On Dec. 29, 1890, some 200 to 300 Sioux, including women and children, were massacred at Wounded Knee by a unit of the United States Cavalry; see **SIoux**; **WOVOKA**.

On Feb. 27, 1973, over 200 armed supporters of the American Indian Movement (A.I.M.) seized Wounded Knee and issued demands that the U.S. Senate begin an investigation of the Sioux grievances. The occupiers held siege to Wounded Knee for seventy days, until May 8, during which time two Indians were killed and several persons on each side were wounded by gunfire exchanged between the Indians and Federal law-enforcement officers who had surrounded the site.

WOVOKA, also known as JACK WILSON (about 1856–1932), American Indian prophet, of the Piute (q.v.), born in what is now Mineral County, Nev. He worked for a rancher, whose surname he acquired. About 1888 Wovoka suffered a fever accompanied by delirium; he claimed to have had a vision of God instructing him to teach his fellow Indians a certain dance ritual, which came to be known as the ghost dance. The dance was supposed to enable the Indians to recover their original lands; to reunite them with their ancestors; and to make it possible for them to live in eternal peace and prosperity. Wovoka's teachings spread rapidly among the Plains Indians (q.v.), who soon regarded him as their messiah (q.v.). By 1890 the ghost dance was performed nightly by many Plains tribes; it helped to precipitate the massacre at Wounded Knee (q.v.) on Dec. 29 of that year and the arrest and slaying of Sioux chief Sitting Bull (q.v.) on Dec. 15; see **SIoux**. Thereafter Wovoka's influence diminished.

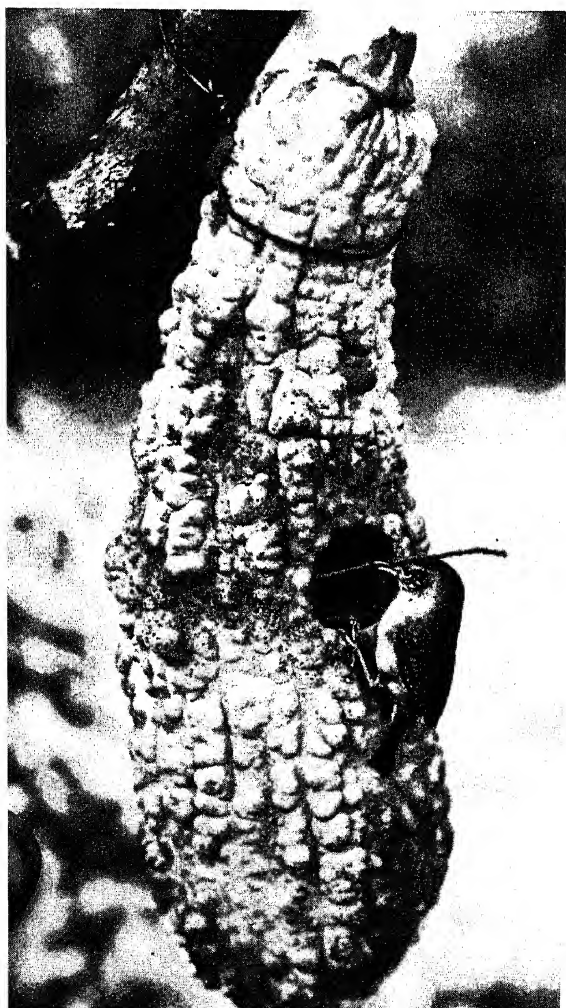
WRANGEL, **Baron Pëtr Nikolaevich** (1878–1928), Russian military leader, born of a noble family in Saint Petersburg (now Leningrad). He was a cavalryman for a period in his youth, worked in mining engineering in Siberia, and served as an officer of a Cossack regiment in the Russo-Japanese War and in World War I (qq.v.). Late in 1917, after the Bolsheviks seized power, Wrangel joined the anti-Bolshevik forces, known as the White Army, in southern Russia, and became their commander in chief early in 1920. For a time he carried on successful operations against the Red Army. The Soviet-Polish armistice of October, 1920, however, enabled the Red Army to concentrate its power against Wrangel. He then fled to Constantinople (now Istanbul), Turkey, with 150,000 followers in November. Wrangel spent his last years as a mining engineer in Brussels, Belgium. See **UNION OF SOVIET SOCIALIST REPUBLICS**; *History: Civil War*.

WRANGEL ISLAND, island of the Soviet Union, administered by the Churchi National Okrug, in the Arctic Ocean, between the East Siberian Sea and the Churchi Sea. It is separated

WRANGEL ISLAND

from the mainland by De Long Strait. The island, a rocky waste with elevations rising to about 3000 ft., is a breeding ground for seals and polar bears. In 1832 the Russian explorer Ferdinand von Wrangel (1794–1870) tried unsuccessfully to find the island, that had been seen and reported by Siberian natives. It was sighted in 1867 by the American whaler Thomas Long, who named it in honor of Wrangel. A Russian expedition was sent to the island in 1911, and in 1916 the czarist government claimed it for Russia. The Canadian explorer Vilhjalmur Stefansson (q.v.) sent a party to the island in 1921, intending to claim it for Great Britain, but all save one of the group perished. In 1924 a Russian vessel forcibly removed a small colony of Eskimo established (1923) there by the United States. In 1926 the U.S.S.R. established a permanent colony on the island, which is now the site of a trading post and a meteorological station. Area, about 1800 sq.mi.

A house wren, *Troglodytes aedon*, builds a nest in a dry squash. UPI



WRANGELL MOUNTAINS, range of lofty volcanic mountains in s.e. Alaska, near the border with the Yukon Territory. The highest peaks are Mt. Sanford (16,208 ft.) and Mt. Blackburn (16,523 ft.). In 1953 the University of Alaska (see ALASKA, UNIVERSITY OF) and New York University (q.v.) established a cosmic-ray-research station on Mt. Wrangell (14,000 ft.), another peak of the range.

WRATH, CAPE, see CAPE WRATH.

WREN, common name applied to numerous species of songbirds, comprising the family Troglodytidae. The group comprises about sixty species, most of which are native to the tropical regions of the Western Hemisphere; the European wrens are much less numerous. Generally very animated birds, wrens display their restlessness by chattering incessantly and twitching their tails. The birds of many species are fine songsters; each species has its own characteristic phrase, which is delivered with surprising loudness. The adults vary in length from 4 to 8½ in. and have a slender, slightly curved bill, short, rounded wings, and a short tail held usually in an erect position. The plumage, alike in the male and female, is usually predominantly brown above, and gray, white, or tawny below with darker streaks or bars. Wrens nest in natural or man-made crevices in trees, rocks, thickets, or farm buildings. The female usually lays from five to eight eggs in a clutch, and most species breed twice a year. The eggs are often white, speckled with brown. Wrens feed largely on insects.

A common species is the house wren, *Troglodytes aedon*, which breeds throughout North America from southern Canada to the northern Gulf States, and winters in the South Atlantic and Gulf States as far south as Mexico. A common midwestern species is Bewick's wren, *Thryomanes bewickii*, noted for its beautiful song. The winter wren, *Troglodytes troglodytes*, is 4 in. long and has a wild, ringing song. The Carolina wren, *Thryothorus ludovicianus*, ranges as far west as Texas.

The cactus wren, *Campylorhynchus brunnei-capillum*, is the largest wren, attaining a length of 8½ in. It is native to the desert regions of the southwestern United States and northern Mexico. Also found in arid regions of western North America is the rock wren, *Salpinctes obsoletus*. It builds its nest in rock crevices and paves a path to it with pebbles and rock chips.

WREN, Sir Christopher (1632–1723), British architect, scientist, and mathematician, born in East Knoyle, Wiltshire, and educated at Wadham College, University of Oxford. The son of a

clergyman, he was a precocious child with remarkable talent for science and mathematics. He had already invented numerous scientific devices before the age of fourteen, when he was admitted to Oxford. While still a student, he made several original contributions in mathematics, winning immediate acclaim. In 1657, after serving as a fellow of All Souls College at Oxford, he was appointed professor of astronomy at Gresham College in London. Three years later he returned to Oxford to accept the post of Savilian professor of astronomy.

Already famous as a scientist and mathematician, Wren started his career as an architect at the age of twenty-nine. Until then he had displayed no practical interest in architecture, but his reputation brought him an unsolicited court appointment as assistant to the surveyor general in charge of the repair and upkeep of public buildings. Thereafter Wren devoted himself to the study of architecture with increasing enthusiasm. His earliest work included designs for several new structures at Oxford and at the University of Cambridge. His first building, the Pembroke College Chapel, was completed in 1665 at Cambridge. The designs of this period reflected the influence of the English architect Inigo Jones (q.v.). In 1665 Wren visited Paris to study French architecture and met such leading European architects as the Italian Giovanni Lorenzo Bernini (q.v.), who exerted an important influence on Wren's subsequent work.

His Famous Designs. After his return to England, the fire of 1666 burned the oldest part of London. Within a few days Wren submitted a brilliant plan for rebuilding the area. The plan anticipated many of the features of modern city planning, but it was rejected because of property disputes. In 1667 he was appointed deputy surveyor general for the reconstruction of Saint Paul's Cathedral (q.v.), numerous parish churches, and other buildings destroyed by the fire. Two years later he received the coveted post of surveyor of the royal works; he held this position for the following fifty years.

Wren's designs for St. Paul's Cathedral were accepted in 1675, and he superintended the building of the vast structure until its completion in 1710. It ranks as one of the world's most imposing domed edifices. He also designed more than fifty churches, many of them, such as Saint Mary-le-Bow (1671-77) in London, famous for their towers and graceful spires. Among his secular buildings still in existence are the Sheldonian Theatre at Oxford (1664-69), the Trinity College library at Cambridge (1677-92), the facade for Hampton Court Palace (1689-94), the



Sir Christopher Wren

British Information Services

Chelsea Hospital (1682), and the Greenwich Observatory (1675).

Evaluation. Wren is considered England's greatest architect, his works displaying great inventiveness in design and engineering. He evolved a simple version of the baroque style, in which the decorative effect is derived chiefly from one particular feature of the building. His style strongly influenced English architecture in the Georgian Period, and his influence also extended to America. The Wren Building (1695) of the College of William and Mary (q.v.) in Williamsburg, Va., is so like his work that some authorities ascribe its design to Wren.

Wren's architectural achievements have obscured his extraordinary contributions in science. Among his inventions were a weather clock comparable to the modern barometer and new methods of engraving and etching. His biological experiments, in which he injected fluids into the veins of animals, played an important role in the development of blood transfusion.

Wren was knighted in 1673; he subsequently served for many years as a member of Parliament. One of the founders of the Royal Society of London for Improving Natural Knowledge (q.v.), he became its president in 1680. He was buried in St. Paul's Cathedral; near his tomb is a tablet inscribed with his epitaph, which ends with the famous words *Si monumentum requiris, circumspice* ("If you seek his monument, look about you").

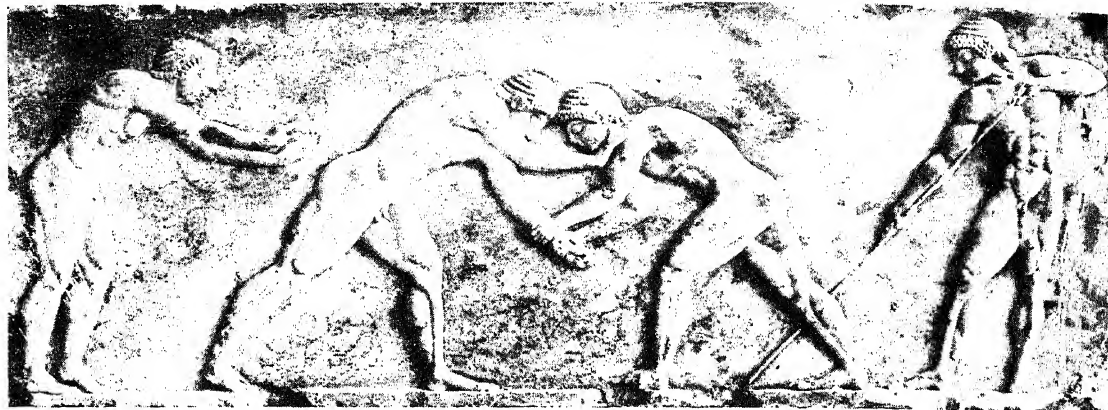
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WREN-TIT, North American bird, *Chamaea fasciata*, the only species in the wren-tit family,

WRESTLING

the Chamaeidae. It is about $6\frac{1}{2}$ in. long, is dusky above and cinnamon brown below, and has a long, rounded tail and white eyes. It lives in thickets and spends much time on the ground, where it is more often heard than seen. The song of the wren-tit is characteristic and is heard throughout the year. It nests in a low

opponent with an arm hold such as the flying mare, a maneuver in which an opponent is flung across the aggressor's shoulder onto the mat. Greco-Roman wrestling is especially popular in Europe. Championship matches in the Greco-Roman style have been conducted in the U.S. under the auspices of the Amateur Athletic



Greek youths wrestling (reproduction of a 6th-century B.C. bas-relief).

Metropolitan Museum of Art

bush and lays three to five greenish-blue eggs. The wren-tit is found only along the Pacific coast and in the interior valley of California.

WRESTLING, sport in which one contestant grapples with another in an attempt to force the shoulders of the opponent against a mat, thus scoring a fall, and winning the match. Two basic styles of amateur wrestling, Greco-Roman and free-style, are employed generally in the modern version of the sport. Karate and jujitsu, other methods of combat originally peculiar to the Orient, are discussed in separate articles. Also popular as a spectator sport in the United States today is exhibition or professional wrestling.

Greco-Roman Wrestling. The distinctive feature of Greco-Roman wrestling is that contestants must apply all holds above the waist, using only the hands and arms. Tripping, tackling, and the use of the legs to secure a hold are not permitted. The Greco-Roman wrestler comes to grips with his opponent in a standing position and attempts to throw him to the ground, or bring him to the mat, in such a way that his shoulders strike the mat simultaneously. If successful he scores a fall, and the match ends. Failing to score a fall in this fashion, the wrestlers may continue the match on the mat. If the allotted time, commonly 9 min., expires without a fall being scored, the mat chairman and referee award the victory to the wrestler who has displayed superior ability and aggressiveness.

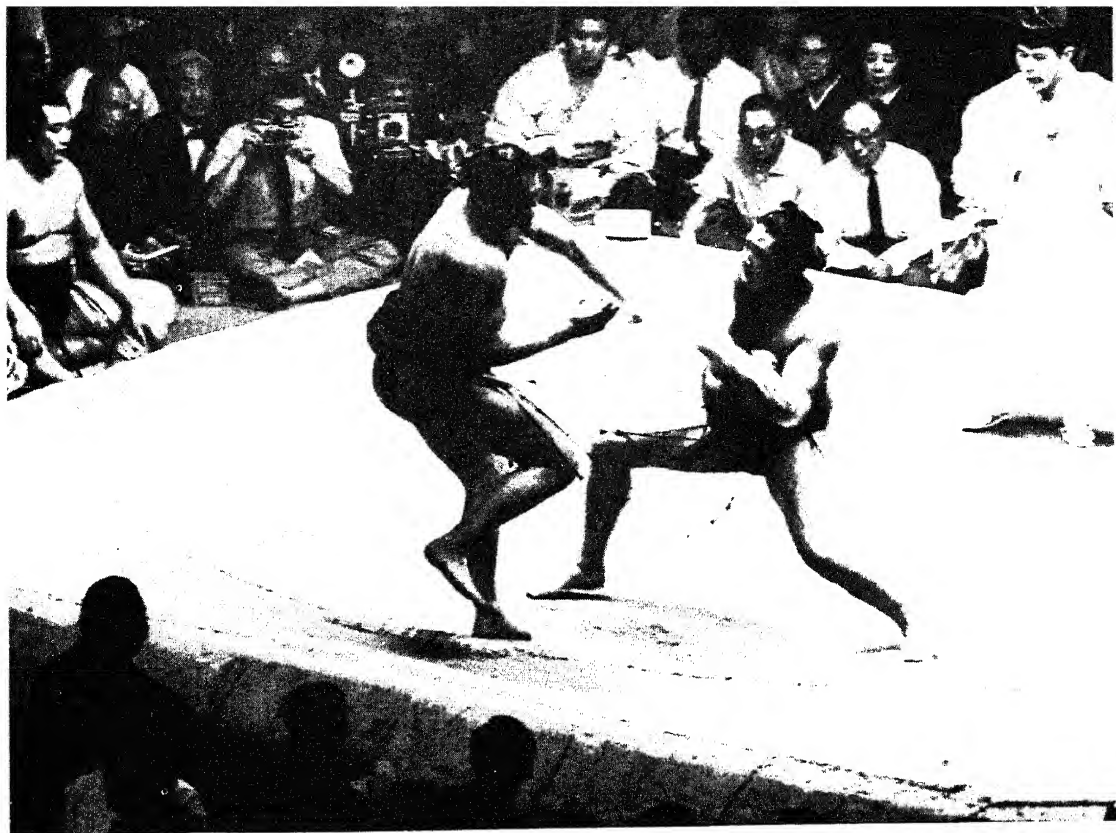
The Greco-Roman wrestler usually downs his

Union (q.v.), known as the A.A.U., since 1953, but free-style wrestling is more popular among Americans.

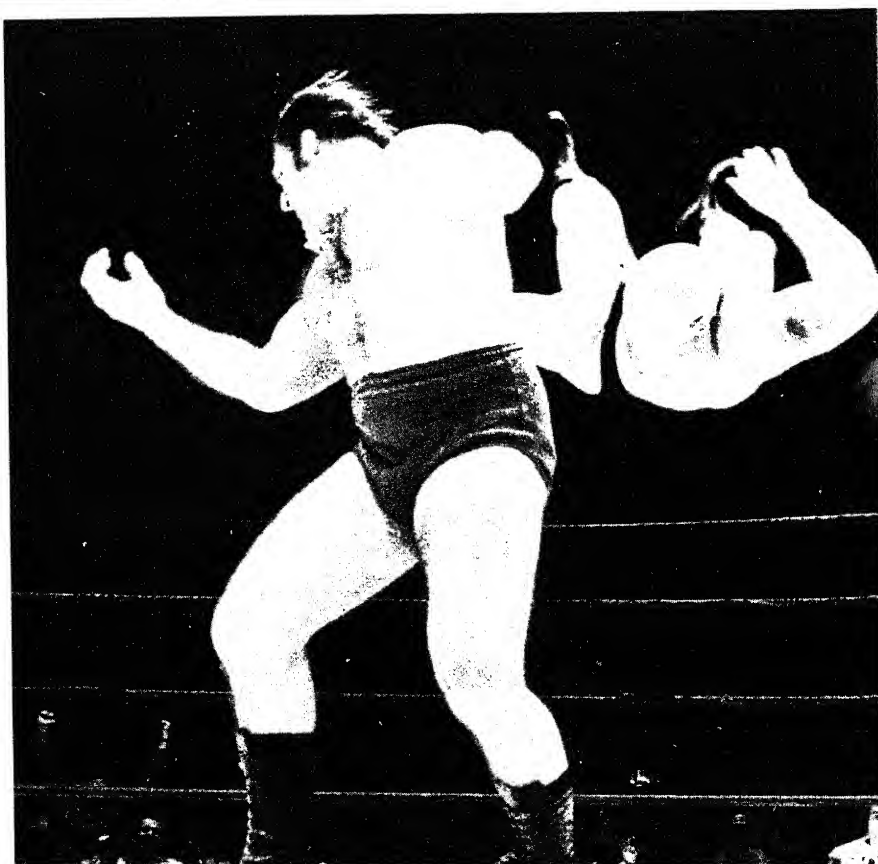
Free-Style Wrestling. Free-style wrestling, often called Olympic free-style, allows a much greater variety of holds than the Greco-Roman style. Contestants may apply holds below the waist and may use their legs for all holds except the body scissors and head scissors. If the shoulders of a contestant are forced to the mat simultaneously, however briefly, a fall is scored and the match ends. If no fall takes place a winner is chosen on a point basis. In Olympic and other free-style tournaments, a victory on points is deprecated, and the victor is penalized with a so-called bad mark. A contestant who amasses a total of six bad marks is eliminated from the tournament. Thus, the rules of free-style tournament competition favor victories achieved by falls.

In 1970 international rules, which govern the Olympic Games (q.v.), called for Greco-Roman and free-style competition in the following weight classes: $105\frac{1}{2}$, $114\frac{1}{2}$, $125\frac{1}{2}$, $136\frac{1}{2}$, $149\frac{1}{2}$, 163, $180\frac{1}{2}$, 198, and 220 lb. The class for wrestlers who weigh more than 220 lb. is designated unlimited.

College Wrestling. Collegiate-style wrestling, once known as catch-as-catch-can, is a form of free-style wrestling highly popular in the U.S. One distinctive feature is that a fall can be scored only by pressing the shoulders of an opponent to the mat for 1 sec. In addition, collegiate style permits the use of the closed body



Above: Combatants in sumo, a centuries-old form of Japanese wrestling, grapple in a sanded ring bound by rice straw. A contestant loses the match if he is forced out of the ring or if any part of his body except his feet touches the ground. Right: Less dignified and more of an entertaining event than a sport is Western-style professional or exhibition wrestling. In 1971 champion Bruno Sammartino tried unsuccessfully to defend his title by sending challenger Ivan Koloff to the canvas. UPI



WRESTLING

scissors and adheres to a fairly elaborate point system which gives credit for time advantages, that is, time spent on top of an opponent, which fall short of achieving an actual fall. The point evaluations reflect the skills and techniques of a wrestling performance. Among such skills are the escape (one point), the near fall (two or three points), and the predicament (one point). By contrast, free-style awards points for only a few maneuvers, for example, take-downs (see below).

The A.A.U. and the National Collegiate Athletic Association (q.v.), known as the N.C.A.A., which conduct the principal amateur wrestling tournaments in the U.S., adhere to slightly different free-style rules, creating difficulty for American wrestlers. The N.C.A.A. collegiate-style bout consists of one 2-min. period followed by two 3-min. periods. A fall scored at any point ends the match. If no fall occurs after 8 min. of wrestling, a winner is chosen on points. If point totals are equal, the match is a draw. In tournaments, two 1-min. overtime periods are used to determine a winner.

General Wrestling Holds. Within the limitations noted above, five general types of holds are common to Greco-Roman, free-style and collegiate-style wrestling. They are: (1) Take-

downs, holds designed to bring a standing opponent to the mat. Common takedowns include the double leg tackle, fireman's carry, and the flying mare. (2) Rides, or hold-downs, designed to upset and take out of position an opponent who is underneath. Typical rides include the tight waist and ankle ride, navy ride, and the cross-body ride. (3) Escapes, or methods of breaking free of an opponent's grip. Such methods include the sit-through, whizzer, and turn-in. (4) Reversals, designed to bring a contestant from an underneath position to a position atop an opponent while both are down on the mat. Popular reversals include the side roll and switch. (5) Pinning combinations, or holds which force the shoulders of an opponent to the mat. These include the cradle, three-quarter nelson, and half nelson with crotch hold.

Amateur wrestling is highly popular in U.S. colleges, preparatory schools, high schools, and athletic clubs. In addition to national A.A.U. and N.C.A.A. championships, hundreds of regional and local tournaments are held each year.

Professional Wrestling. Exhibition wrestling is the only form of professional wrestling currently popular in the U.S. Because the chief purpose of such wrestling is entertainment, both the action and the outcome of exhibition matches are carefully rehearsed in advance to be dramatic or humorous. Most States require therefore that

Amateur wrestling is a popular college sport.

UPI



they be advertised as exhibitions, rather than as contests. The action takes place in a roped-off ring about 18 ft. square. One of the contestants, assuming usually a villainous attitude, pretends to inflict damage on his opponent with simulated eye-gouges, finger-twists, and other illegal tactics. Meanwhile his opponent wins the sympathy of the spectators by confining himself to orthodox wrestling holds, and in the end he usually triumphs over his tormentor.

Besides traditional holds and the tactics mentioned above, exhibition wrestlers employ a number of spectacular maneuvers, among them the so-called airplane spin, the Irish whip, the flying tackle, and the Argentine back-breaker. Exhibition wrestlers, usually assuming roles with an ethnic or colorfully eccentric appeal, are often billed under exotic pseudonyms. Among the colorfully-named exhibition wrestlers have been "Gorgeous George", "Lord Carlton", "Nature Boy" and "Gorilla Monsoon". They characteristically wear flamboyant dressing gowns and other eye-catching regalia.

Legitimate or genuine professional wrestling was vastly popular in the U.S. from 1880 to 1920. Victory went to the wrestler scoring two falls out of three. Bouts often were contested in a mixed style, that is, one fall was wrestled in the catch-as-catch-can style, another in the Greco-Roman. The style used for the third fall, if any, was decided by the toss of a coin. No time limit was imposed on matches.

History. Wrestling has been popular in various countries throughout recorded history. Early Egyptian and Babylonian tablets dating from 3000 B.C. depict wrestlers using most of the holds known to the present-day sport. In ancient Greece wrestling occupied a prominent place in legend and literature; wrestling competition was the supreme contest of the Olympian Games (q.v.), where it was the climactic event of the pentathlon (q.v.). Greek athletes practiced two styles of wrestling. One was a stand-up form similar in some ways to present-day Greco-Roman; the other form, a rough-and-tumble style fought both standing and on the ground, was replete with eye-gouging, the breaking of fingers, and other brutal tactics. In some Greek states women wrestlers competed against men. Fragments of a Greek textbook on wrestling have survived.

The ancient Romans borrowed heavily from Greek wrestling; they eliminated many of its most brutal aspects, but added little that was new.

During the Middle Ages wrestling remained popular and received the patronage of many

royal houses, notably those of France, Japan, and England. Early English records reveal that in 1222 a team of London wrestlers won an inter-city competition with Westminster. Henry VIII, King of England, was such a wrestling enthusiast that in 1520 he challenged Francis I (qq.v.), King of France, to a bout, and was thrown.

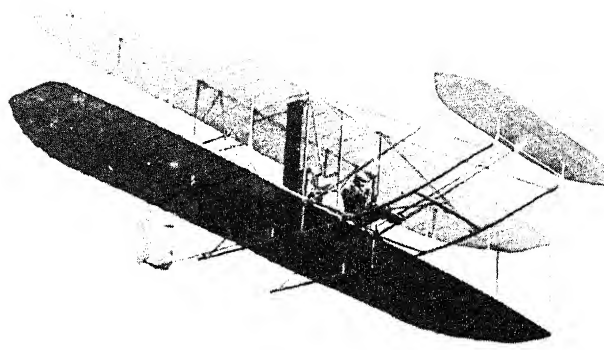
AMERICA. In America the early colonists found wrestling popular among the Indians. These early American settlers brought with them from England a variety of wrestling styles, including the Cornish, Westmorland, and Lancashire catch-as-catch-can. Only the last-named style survives, though in modified form. During the 19th century, amateur wrestling was a favorite sport in U.S. rural districts and became the featured event at picnics, threshing bees, and holiday celebrations. Interest in amateur wrestling dwindled in the U.S. during the first few decades of the 20th century. Current enthusiasm for the sport dates from the 1930's.

Professional wrestling became a major American spectator sport during the 1880's. The first professionals were featured in carnivals. They attracted large crowds by offering cash prizes to any local champion who could throw them. Professional wrestling reached its zenith during the early decades of the 20th century, when huge crowds turned out to see such masters as Frank Gotch, Stanislaus Zbyszko, George Hackenschmidt, Ed ("Strangler") Lewis, and Jim Londos, all of whom held the championship for varying periods. During the early 1920's legitimate professional wrestling finally gave way to exhibition wrestling.

WRIGHT, name of two American brothers who worked closely together in the early development of aeronautics; they invented and flew the first practical airplane.

Wilbur Wright (1867–1912) born in Millville, Ind. As boys, he and his younger brother Orville made simple mechanical toys, and in 1888 they built a large printing press. The following year they began to publish the Dayton, Ohio, *West Side News*, edited by Wilbur. Already successful printers, the brothers opened a bicycle repair shop and showroom in 1892, and three years later they began assembling bicycles with tools of their own invention.

The Wrights were admirers of the writings and feats of the German engineer Otto Lilienthal, the American engineer Octave Chanute (qq.v.), and other glider (q.v.) experimenters. In September, 1900, at Kill Devil Hill, near Kitty Hawk, N.C., they tested their own glider. Carefully recording their findings, they concluded that the previously accepted aeronautical data



Orville Wright flies the Wright Type-A biplane at Ft. Myer, Va., in 1908.

U.S. Air Force

on which they had relied were erroneous. In 1901 the brothers tested the effects of air pressure on more than 200 wing surfaces and in 1902, executing almost 1000 glides in a new glider, they confirmed their Kitty Hawk data. At Kitty Hawk the Wrights also proved to their satisfaction that planes could be balanced best by pilots, rather than by built-in engineering devices; this was the major idea covered by the first Wright patent.

In 1903 the brothers constructed their first propeller (q.v.), from original calculations; it was about 35 percent more effective than other propellers then available. They next built a 750-lb. machine with a 12-h.p. motor in which, on Dec. 17, 1903, at Kitty Hawk, first Orville and then Wilbur made the first powered flights in history. Despite public indifference they dedicated themselves to the development of better engines and planes. The site of the first flight, preserved as the Wright Brothers National Memorial, is administered by the National Park Service (q.v.).

In 1908 Wilbur Wright set distance and altitude records in France. That same year the

Wright fulfilled a contract with the United States Army Signal Corps to produce a plane that could fly for 10 min. at a speed of 40 m.p.h. They then toured Europe, where they were highly honored. Upon their return to the United States in 1909 they received further honors, including medals presented by President William Howard Taft (q.v.). That same year Wilbur Wright became president of the newly incorporated American Wright Company. He died three years later of typhoid fever.

Orville Wright (1871–1948), born in Dayton, Ohio. Orville's individual contributions to the improvement of aircraft include the development of the first wind tunnel (q.v.), in 1901, and the discovery, in 1902, that tailspins could be eliminated by substituting a movable vertical tail for the stationary one then in use.

In 1903 at Kitty Hawk, N.C., Orville Wright made the first successful flight, which lasted 12 sec., in a self-powered craft. On Sept. 9, 1908, at Fort Meyer, Va., he simultaneously established several records when he flew the first Wright plane made under government contract for 62 min., completing 57 circles at an altitude of 120 ft.; he became an immediate international celebrity. In 1910 Orville Wright formed the first

Wright Exhibition Team, in which pilots trained by him performed in Wright planes. He also personally tested each new piece of equipment used on Wright planes and superintended production at the Wright plants. After the death of Wilbur in 1912, Orville Wright became president of the American Wright Company. Three years later he sold his stock in the company for over \$500,000. He subsequently worked as an engineering consultant.

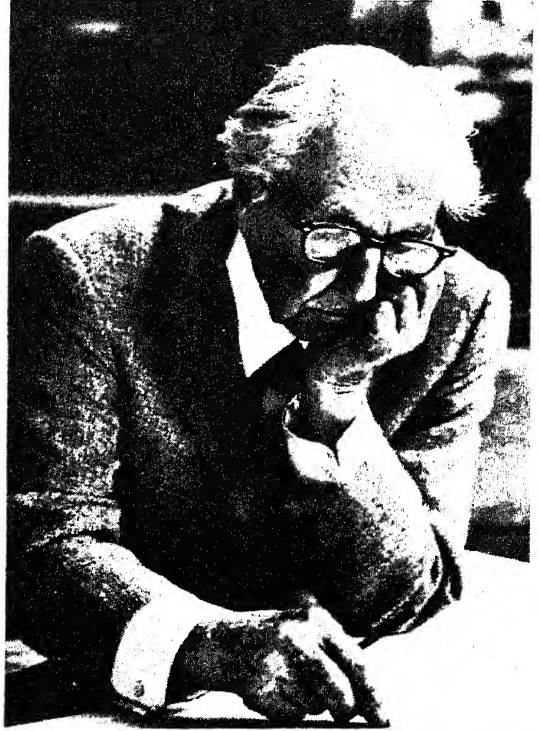
See AIRPLANE: *Development*; AVIATION: *Kitty Hawk and After*.

WRIGHT, Frances or WRIGHT, Fanny (1795–1852), Anglo-American social reformer, born in Dundee, Scotland. She grew up in London, England, toured the United States from 1818 to 1820, and reported enthusiastically on her experiences in *Views of Society and Manners in America* (1821). This volume won her the friendship of many liberal thinkers, among them the French military leader and American Revolutionary hero Marquis de Lafayette (q.v.). In 1824 she accompanied him on his historic tour of the U.S., and later the same year, Miss Wright established Nashoba, an experimental community near Memphis, Tenn., designed to prepare slaves for emancipation. Swamp fever, sensational negative publicity, and other problems arose, and the experiment failed. In 1828 she began to lecture and became coeditor of the *New Harmony Gazette* with the American legislator Robert Dale Owen (see under OWEN). The next year she and Owen founded the *Free Inquirer* as successor to the *Gazette*. In both her lectures and her writings Frances Wright vigorously advocated abolition, universal education, birth control, and equal rights for women. Her works include *A Few Days in Athens* (1822) and *Course of Popular Lectures* (2 vol., 1829–36).

WRIGHT, Frank Lloyd (1867–1959), American architect, born in Richland Center, Wis., and educated at the University of Wisconsin. When Wright entered the university in 1884, his interest in architecture had already declared itself. The university offered no courses in his chosen field, however, and he matriculated in civil engineering and gained some practical experience by working part time on a construction project at the university. In 1887 he left school and went to Chicago, where he became a designer for the firm of Adler and Sullivan. One of the partners of this company, the American architect Louis Sullivan (q.v.), had a profound influence on Wright's work. In 1893 Wright left the firm to establish his own office in Chicago.

"Organic Architecture". A pioneer in modern architecture, Wright is considered by many as

the greatest American architect of his time. He created the philosophy of "organic architecture", the central principle of which maintains that the building should develop out of its natural surroundings. From the outset he exhibited bold originality in his designs for both private

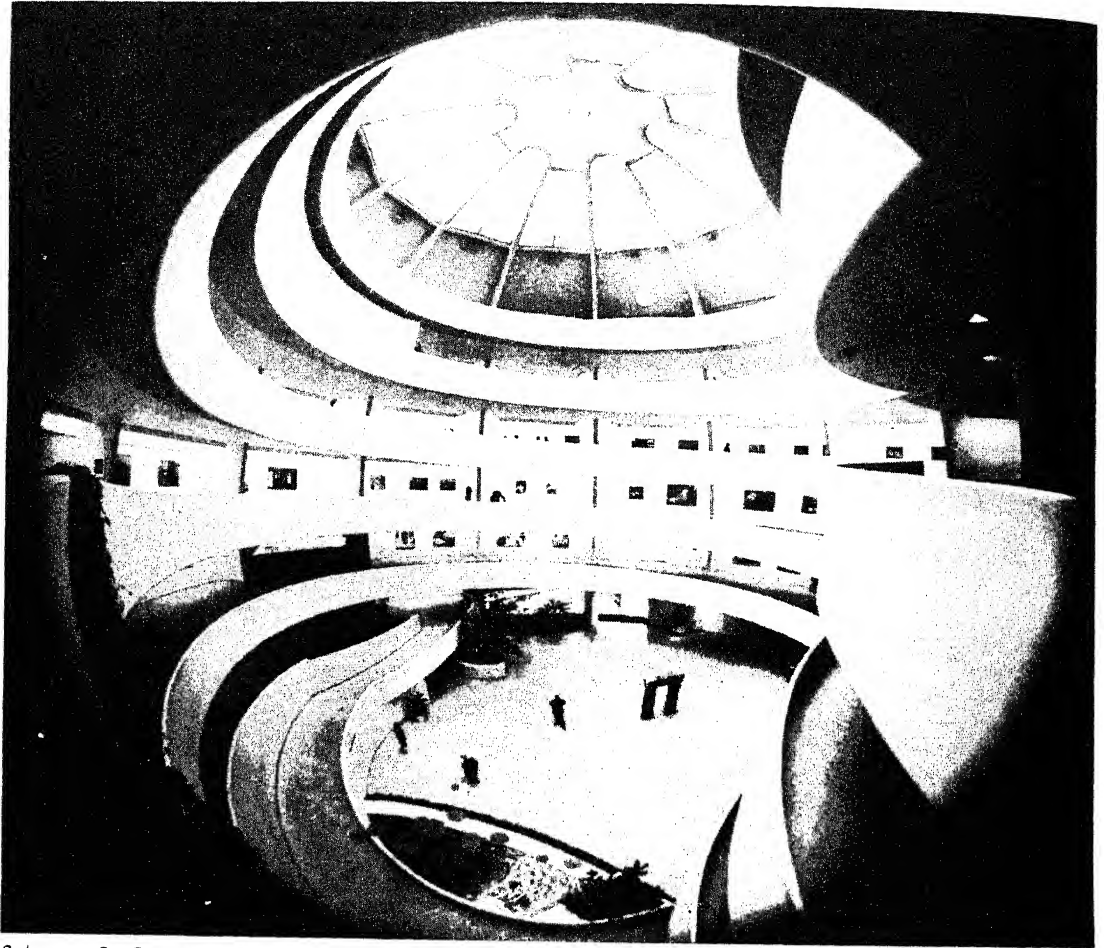


Frank Lloyd Wright

Viking Press

and public structures and rebelled against the ornate neoclassic and Victorian styles favored by conventional architects. Wright was opposed to the mechanical imposition of preconceived styles. He believed that the architectural form must ultimately be determined in each case by the particular function of the building, its environment, and the type of materials employed in the structure. Among his fundamental contributions was the use of various building materials for their natural colors and textures, as well as for their structural characteristics. His interiors emphasize the sense of spaciousness, which derives from open planning with one room flowing into another. This concept was particularly evident in his early single-family houses, the so-called prairie houses, among them the Martin House in Buffalo, N.Y. (1904); the Coonley House in Riverdale, Ill. (1908); and the Robie House in Chicago, Ill. (1909).

New Techniques. Wright initiated many new techniques, such as the use of precast concrete



Solomon R. Guggenheim Museum, New York City. Wright's design, a circular building, has a spiral ramp that serves as a continuous exhibition area.

American Airlines

blocks reinforced by steel rods. He also introduced numerous innovations, including air conditioning, indirect lighting, and panel heating. The Larkin Building in Buffalo, N.Y., which he designed in 1905, was the first office building to utilize air conditioning, double-glass windows, all-glass doors, and metal furniture. Among his remarkable engineering feats was the design of the huge Imperial Hotel in Tokyo, constructed to withstand earthquakes. To obtain the required flexibility, he employed cantilever construction with a foundation floating on a bed of soft mud. The building was completed in 1922, and it suffered no damage in the disastrous earthquake that occurred in the following year.

Throughout his career, architects who were more conventional than Wright opposed his unorthodox methods. Beset with personal dif-

ficulties and professional antagonisms, he passed a year of self-imposed exile (1909–10) in Europe. Upon his return, he began anew on a career of ever-widening achievements. Among his later works are the Millard House in Pasadena, Calif. (1921), the Kaufmann House, called *Fallingwater*, at Bear Run, Pa. (1936), the Johnson Administration Building in Racine, Wis. (1938), the First Unitarian Meetinghouse in Madison, Wis. (1949), the V. C. Morris gift shop in San Francisco (1950), and the Price Tower, a skyscraper in Bartlesville, Okla. (1955). In 1953 he completed the plans for the Solomon R. Guggenheim Museum building, which is his only structure in New York City.

Other Interests. Wright spent much time in writing, lecturing, and teaching. By 1908 he had originated most of the principles which are today the fundamental concepts of modern architecture. Although his early struggle against eclecticism won him the hostility of the American academicians, nevertheless his work pro-

foundly influenced the development of contemporary architecture in the United States as well as in Europe. Wright was the founder and director of the Taliesin Fellowship, a studio-workshop for apprentices who studied under him and assisted him on his projects. His writings include *An Autobiography* (1932; rev. ed., 1943), *An Organic Architecture* (1939), *Genius and the Mobocracy* (1949), and *Natural House* (1954).

See also AMERICAN ARCHITECTURE: *Modern American Architecture: Frank Lloyd Wright and the Prairie Style (1890's-1950's)*. A.K.P.

WRIGHT, John Joseph, Cardinal (1909-79), American Roman Catholic prelate, born in Boston, Mass., and educated at Boston College, Saint John's Seminary in Boston, and the Pontifical Gregorian University in Rome. Ordained a priest in 1935, Wright served fifteen years in the archdiocese of Boston, first as a professor of philosophy at St. John's Seminary and later as archdiocesan secretary. In 1947 he was consecrated a bishop, and three years later was appointed the first bishop of Worcester, Mass. In 1959 he succeeded John Francis Cardinal Dearden (q.v.) as bishop of Pittsburgh, Pa. Pope Paul VI (see under PAUL) elevated Wright to the rank of cardinal in 1969. Cardinal Wright wrote several books, among them his doctoral dissertation published in 1942 as *National Patriotism in Papal Teachings*.

WRIGHT, Richard (1908-60), American author, born near Natchez, Miss. He spent his early life in poverty, living for a while in Memphis, Tenn., and traveling throughout the United States working at a variety of menial jobs. In 1935 he settled in Chicago, Ill., and began to work with the writers program of the Works Progress Administration, later renamed the Work Projects Administration (q.v.), an agency of the Federal government. In the early 1930's Wright joined the Communist Party; but he describes his disillusionment with the party in his contribution to *The God That Failed* (1950); the book comprises six essays by former Communists explaining their later rejection of Communism (q.v.). He left the U.S. in 1950 to settle in Paris.

Wright's first published book, *Uncle Tom's Children* (1938), a collection of four short melodramatic novels, eloquently dramatizes race prejudice. His major work, *Native Son* (1940), explores the violent psychological pressures that drive a young Chicago Negro, Bigger Thomas, to murder. This highly successful novel was produced as a play in 1941 and as a motion picture in 1950. In his autobiography, *Black Boy* (1945),

Wright reveals in bitter personal terms the devastating impact of prejudice on a Negro in the U.S. during his formative years.

Wright, regarded as perhaps the most eloquent spokesman for his generation of Negroes, also wrote *The Outsider* (1953), a philosophical



Richard Wright

Edith Kean

novel; *White Man, Listen!* (1957), further observations on racial problems; *The Long Dream* (1958), a novel of slum life; and works on his travels in Spain, Africa, and Southeast Asia. Published posthumously were *Eight Men* (1961), *Lawd Today* (1963), and the autobiographical *American Hunger* (1977). See also NEGRO LITERATURE, AMERICAN: *The Harlem Renaissance to 1950*.

WRIGHT, Sewall (1889-), American geneticist, born in Melrose, Mass., and educated at Lombard College, Galesburg, Ill., the University of Illinois, and Harvard University. He was employed as an animal geneticist by the United States Department of Agriculture (1915-25), taught zoology at the University of Chicago (1926-54), and was a professor of genetics at the University of Wisconsin (1955-60). Wright is best known for his genetic studies of guinea pigs and for his research on evolution (q.v.) and received the National Medal of Science in 1967. He originated the mathematical theory of evolu-

tion stating that mathematical chance, as well as mutation and survival of the fittest, affects evolutionary change. See HEREDITY.

WRIGHT, Willard Huntington (1888–1939), American critic and writer, born in Charlottesville, Va., and educated at Saint Vincent and Pomona colleges in California, and Harvard University. Beginning in 1907 he worked as a literary and art critic for a number of periodicals, and from 1912 to 1914 he also edited the magazine *Smart Set*. By the age of thirty-five he had published several volumes of art criticism, including *Modern Painting* (1915) and *The Future of Painting* (1923). Seriously ill between 1923 and 1925, Wright limited himself after his recovery to writing detective fiction under the pen name of S. S. Van Dine. Wright's sleuth protagonist is Philo Vance, whose suavity and esoteric learning were distinctive characteristics of Wright himself. Among the most notable mysteries featuring Vance are *The Benson Murder Case* (1926), *The Canary Murder Case* (1927), and *The Kidnap Murder Case* (1936).

WRIT, in law, documentary court orders issued to authorize actions in specific legal situations. Writs variously prescribe or forbid certain acts, enforce rights, or redress wrongs. A writ of habeas corpus (q.v.), for example, safeguards individuals from being unlawfully taken into custody, and a writ of error from a superior court orders an inferior court to provide records of legal proceedings in order to ascertain whether the law has been erroneously applied. The term "writ" was formerly applied in Anglo-Saxon England to any written, sealed pronouncements by the king. See ATTAINER; CERTIORARI; CONSTITUTION OF THE UNITED STATES; SEARCH WARRANT; SUBPOENA; SUMMONS.

WRITING, method of human intercommunication and of recording ideas by means of arbitrary visual marks forming a system. Writing can be achieved in either limited or full systems, a full system being one that is capable of expressing unambiguously any concept that can be formulated in language (q.v.).

Limited Writing Systems. Limited writing systems are generally used for purposes such as keeping accounts or as mnemonic devices for recalling significant facts or conveying general meanings. Also called sub-writing, limited systems of writing include picture writing or pictography, ideography, and also the use of marked or unmarked objects as mnemonic devices. Such systems are characterized by a high degree of ambiguity because there is no fixed correspondence between the signs of the writing system and the language represented. For

this reason interpretation of a limited system is usually independent of language. The purpose of the pictogram, ideogram, or object is to call to mind an image or impression that is subsequently expressed in language. This is clearly the procedure involved in the American Indian picture writing which can be "read" easily by practically anyone without the slightest knowledge of American Indian languages (q.v.). On the other hand, interpretation of limited writing systems requires a knowledge of the cultural background of the writer because otherwise the image or impression called to mind by the writing will be meaningless or misunderstood.

Full Writing Systems. A full writing system is capable of expressing any concept which can be formulated in language. Because of this, full writing systems are characterized by a more or less fixed correspondence between the signs of the writing system and elements of the language the writing expresses. The elements of language so represented can be words, syllables, or phonemes (the smallest units of speech that distinguish two different utterances in a language), and thus writing systems can be categorized as word or logographic, syllabic, or alphabetic. Because full writing systems represent elements of language, knowledge of the language written is required to understand the meaning intended by the writer. This does not mean that a writing system is tied to one language. In fact, writing systems are rather easily transferred from one language to another. This means only that unlike a pictographic system, a full system conveys no meaning to the reader without a knowledge of the underlying language.

Word or Logogram Systems. Word writing systems are characterized by having signs called logograms which represent complete words. Such signs frequently represent a series of related words, and in many cases one sign represents several separate and distinct words. In purely logographic writing, such distinctions usually remain unresolved and the writing is ambiguous. Certain types of signs, however, can be used to resolve the ambiguity and assure the proper reading of the logogram. These signs are used as semantic and phonetic indicators, often called determinatives and phonetic complements. Determinatives are signs used to indicate the class or category to which the word represented by the logogram belongs. Determinatives are logograms themselves and are not read but serve only to indicate the semantic group, such as gods, countries, birds, fish, verbs of motion, verbs of building, objects made of wood, objects made of stone, and so on, to

which the logogram which is to be read belongs. Phonetic complements are similar in use but more specific in that they show part or all of the pronunciation of the word that the logogram represents. In modern alphabetic writing in English for example, the logogram "2" is read "two". When the ordinal number is referred to, however, the phonetic complement "nd" is attached and the logogram, plus complement "2nd", is read "second". In this example, for the first time, signs are used for purely phonetic (or non-logographic) purposes. In other words the sign functions not to call to mind an idea and the word associated with it, but to recall a sound which is part of the word which the logogram being read represents. Originally, phonetic indicators were chosen from the logograms which have a reading corresponding to the sound desired. This device is known as phonetic transfer or, more commonly, rebus writing. Like determinatives, phonetic indicators are not to be read but serve only to facilitate the reading of the basic logogram.

Thus far, elements of language are expressed only by logograms. Such representation is adequate for most nouns and simple verbs, but quite inadequate for most adjectives and adverbs, and especially for pronouns and proper nouns such as personal names. It cannot express all the nuances of case endings and verbal inflection. A full system of writing as defined above must be capable of expressing all these if they exist in the language, so it can be seen that a purely logographic writing system cannot be classified as a full system even if it makes use of semantic and phonetic indicators.

Syllabic Systems. The principle of phonetic transfer was used to overcome the limitations of logographic writings. By using signs to represent sounds, in this case syllables, words which had no logographic representation could be expressed. In addition, morphemes, or case endings and verbal inflection could be expressed by attaching the signs representing their sounds to the root logogram. It should be noted that, unlike phonetic indicators, such signs are to be read and interpreted as elements of the language being written.

The combined logo-syllabic system represents the first system of full writing. Once a system has reached a full capability of expression, the conflict in its development is between economy of writing (number of signs required to write a given utterance), and reduction of ambiguity. The major disadvantage of a logo-syllabic system is that it requires a very large number of signs because the number of words in a lan-

guage is quite large. Grouping all words with similar meanings under one logogram, or using the same sign for different words, reduces the number of signs required, but such a system still needs at least 500 or 600 signs. Furthermore, ambiguity is very likely unless indicators are used, which means sacrificing the main advantage of having to use fewer signs per utterance. On the other hand, the number of signs needed for a purely syllabic system can be less than 100 and is seldom more than 200. The use of syllabic writing has the further advantage that the logograms do not have to be interpreted by the reader because the words are written out unambiguously in the phonetic script. The disadvantage of syllabic writing is that the system requires, on the average, more signs to write a given utterance. In its simplest form, a syllabic system consists only of consonant and vowel signs, and signs for simple vowels.

The next step is the reduction of the syllabary, or the list of syllables, to only consonant and vowel signs, with the vowels not differentiated. This reduces the number of signs required to the number of consonant sounds in the language, but increases the ambiguity in that the correct vowel sounds have to be supplied by the reader. Because this is syllabic writing the number of signs required to write a given utterance is the same as that for the simple syllabic system which expresses each vowel fully. But because the reduced syllabic system requires many fewer signs, each sign can be simpler. Although this type of writing is considered alphabetic by many people, it is more properly semi-alphabetic as it does not indicate each phoneme of the language separately and unambiguously.

Alphabetic Systems. The final step toward fully alphabetic writing was the separation of the consonant sounds from the vowel sounds, and the writing of each separately. This requires a few more signs but eliminates the ambiguity of having the reader supply the vowels. Alphabetic writing requires the greatest number of signs for a given utterance, but the number of signs required for the system is small enough so they can still be very simple. Because each sign represents a phoneme, the word intended by the writer is spelled out explicitly, and no sounds are required to be supplied by the reader. See ALPHABET.

These systems outline the theory and methods of writing, but in actual fact writing systems do not exist in these pure forms. Elements from one type of system are almost always found incorporated in another; an example is the num-

WRITING

ber of logograms used with the modern alphabetic writing system.

Writing systems always tended to be conservative, their origins often being attributed to divine sources. Any change or modification was met with great hesitation, and even today, attempts to reform spelling or eliminate inconsistencies in writing conventions meet with strong resistance. Because of this conservatism major innovations in the structure of a writing system usually occurred when one people borrowed a system from another people. The Akkadians, for example, adapted the syllabic portion of the Sumerian logo-syllabic system to their own language, but retained the logograms, and used them regularly as a type of shorthand; see SUMERIAN LANGUAGE AND LITERATURE. When the Hittites borrowed the system from the Akkadians for their own language, they eliminated most of the polyphonous and homophonous syllabic signs and many of the Sumerian logograms, but used a number of Akkadian syllabic spellings as logograms; see HITTITE LANGUAGE; HITTITES.

The earliest known writing dates to shortly before 3000 B.C., and is attributed to the Sumerians of Mesopotamia (q.v.); see SUMER. Because this earliest writing is logographic, it can be read only in vague terms, but the principle of phonetic transfer is apparent and was well on its way to becoming logo-syllabic. Egyptian hieroglyphic writing is known from about a hundred years later, and it is also the earliest authentication of the principle of phonetic transfer; see EGYPTIAN LANGUAGE AND LITERATURE; HIEROGLYPHICS. It is possible that the development of Egyptian writing came as a result of Sumerian stimulus.

At about the same time, so called Proto-Elamite writing developed in Elam (q.v.). This system has yet to be deciphered, and nothing can be said of its nature at the present time except that, from the number of signs used, it is logo-syllabic. Logo-syllabic systems of writing also developed, at a later date, in the Aegean, in Anatolia, in the Indus Valley, and in China; see CHINESE LANGUAGE. From these logo-syllabic systems, syllabaries were borrowed by other peoples to write their own languages. The syllabary in its simplest and most reduced form (that is, signs for consonant plus any vowel) was borrowed by the Semitic peoples of Palestine and Syria from the Egyptians, leaving behind the logograms and more complex syllables of the Egyptian system, during the last half of the 2nd millennium B.C.; see SEMITIC LANGUAGES. This syllabary was almost ready-made because Egyptian writing had never expressed vowels. The earliest such semi-alphabetic writing is found in the so-called Proto-

Sinaitic inscriptions, which date back to about 1500 B.C. Another such system, dated to about 1300 B.C., was found at Ugarit on the northern Syrian coast, but in this case the writing was inscribed on clay in the manner of Mesopotamian cuneiform (q.v.). Similar writing systems were developed by the other peoples of this region, and it was from the Phoenicians that the Greeks borrowed their writing system; see PHOENICIAN LANGUAGE. The Greeks took the final step of separating the consonants from the vowels and writing each separately, thus arriving at full alphabetic writing about 800 B.C.; see GREEK LANGUAGE: *Ancient Greek*. Alphabetic writing has yet to be improved upon in terms of the definition of a full writing system. See also separate articles on all the individual letters of the English alphabet.

I.J.G. & R.M.W.
WROCLAW (Ger. *Breslau*), city and port in Poland, and capital of Wrocław Province, formerly capital of the Prussian province of Lower Silesia (liquidated after World War II). The city is on the Oder R., about 185 miles S.W. of Warsaw, and is the fourth-largest city of Poland in population and an important commercial and industrial center. It is an important railway center. The Oder R., a major artery of trade, links the city with the Baltic Sea and with the Elbe-Vistula network of inland waterways. Located in a rich agricultural and mining region, the city has an extensive trade in wool, grain, iron and other metals, and coal. Industrial establishments include iron foundries, breweries, textile mills, and plants engaged in the manufacture of machinery, locomotives, railway cars, furniture, jewelry, musical instruments, distilled liquors, and cigars.

The site of Wrocław lies on both sides of the Oder, and numerous bridges connect the two sections of the city. The principal section, on the W. bank, centers around the so-called Inner Town, much of which dates from medieval times. Eastern Wrocław, the modern section of the city, is well planned and mainly residential. In the Inner Town are several noteworthy, ecclesiastical edifices, particularly the Roman Catholic cathedral of Saint John the Baptist, begun in 1158 and the oldest church in the city; the Church of Saint Elizabeth (13th century); the Church of the Holy Cross (13th–14th centuries); and the Church of Our Lady of the Sand (14th century). The most interesting secular edifice in Wrocław is the Rathaus (town hall), dating from the 13th century and rebuilt in the 15th century in the Gothic architectural style. Other important structures are the former royal palace, several government buildings, the Museum of Fine

Arts, and the buildings of the University of Wrocław. Built from 1728 to 1736 as a Jesuit college, the university maintains a famous library, art gallery, and astronomical observatory.

History. Known originally as Vratislavia, Wrocław figured in the recorded history of Poland as early as 1000. It was made an episcopal see during the 11th century. On the formation (1163) of the duchy of Silesia the town became the ducal capital. During the 13th century large numbers of Germans settled in the area, and the town acquired its German name, Breslau, in 1261. The town, a prosperous mercantile center, joined the federation of north German towns known as the Hanseatic League (q.v.) in 1294. Bohemia acquired Breslau in 1335. Through the accession (1526) of the Spanish prince Ferdinand I (q.v.) to the Bohemian throne it became a Hapsburg possession. Breslau was seized (1741) by Prussia during the War of the Austrian Succession; see SUCCESSION WARS. Except for a few brief periods of military occupation, notably during the Napoleonic Wars (q.v.), Breslau remained a part of Prussian Silesia until its capture (May 7, 1945) in World War II by Soviet troops. After the collapse of Germany, the city, which suffered heavy damage during the war, reverted to Poland by decision of the Potsdam Conference (q.v.). The German population of Wrocław was subsequently deported and largely replaced by Polish settlers. Pop. (1971 est.) 528,000.

WROUGHT IRON, strong, malleable, rust-resistant, almost pure form of iron that contains 1 to 2 percent silicate slag and less than 0.3 percent carbon. The earliest known form of iron, it was smelted in hearths with charcoal as fuel until about 1400 A.D., when blast furnaces—essentially raised, enclosed hearths—were introduced in southern Europe. The blast-furnace method, by which the molten ore was run off into ingots called “pigs” and further treated to eliminate excess carbon, prevailed until the more efficient puddling furnace was invented in the late 18th century. For modern smelting methods, see IRON AND STEEL MANUFACTURE: *Wrought Iron*.

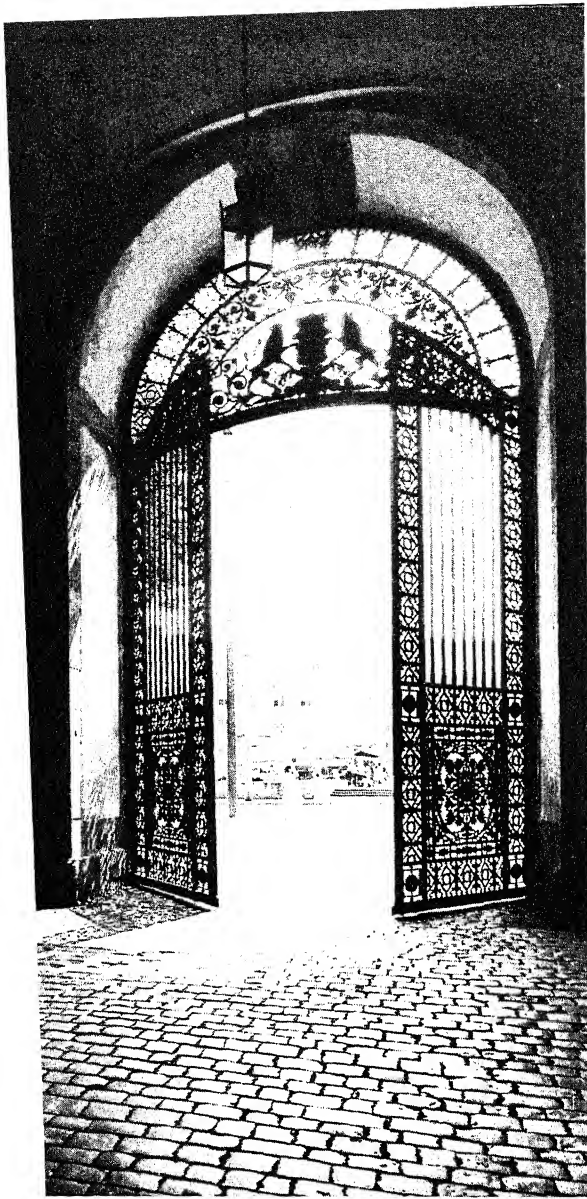
Wrought iron, as opposed to cast iron, is worked in a forge using hammer and anvil. The heated iron, resting on the anvil, is given rapid hammer blows to shape it; when hot, the metal shapes easily, but when cooled it is inflexible. Unlike most metals, iron welds perfectly when two hot pieces are hammered together, a fact that has governed its typical decorative form: scrollwork branching from hammer-welded joints with surface decoration made by hammer, punch, or chisel. Apart from ornamental iron-

work, wrought iron is today chiefly used for tubing, bolts, chains, and anchors. As a construction material it has been largely replaced by steel, which contains more carbon and other alloying elements and is lighter and more flexible.

Early Use. Wrought iron seems to have originated in the Middle East; in Egyptian texts of about 3500 B.C. there is mention of smelted iron, and an iron hammer, spear, and saw have been unearthed from a Sumerian tomb of about 3000 B.C. The Greeks valued iron for its use in making tools. Wrought-iron window grilles survive from the Roman towns of Pompeii and Herculaneum. The Romans had iron keys of the latch-lifter type, and their legionary soldiers used thick, two-edged iron swords. British Celts used wrought iron for currency bars, tools, and chariot wheels. The Anglo-Saxons and Vikings used iron for arms and utensils like the 7th-century A.D. Sutton Hoo helmet and hanging bowls now in the British Museum, London. In India, a 22-ft.-high welded iron pillar still stands in the mosque of Altansh, Delhi; this dates from around 400 A.D.

Decorative Ironwork. The second millennium A.D. saw the true beginning of European decorative ironwork, especially on church doors, the hinges of which were designed in variations on the spiral with branches and stylized leaf or flower terminals. An unusual early door (about 1050) at Staplehurst, England, with figures of a ship, fish, and dragons, relates a story now obscure. The doors of Notre Dame Cathedral (13th cent.) in Paris show remarkable virtuosity, having scrolls that burgeon with dragons and birds. Cathedrals also needed internal iron furnishings like tomb and sanctuary grilles. The remnants of Saint Swithin's grille (about 1093) in Winchester Cathedral in England have a scroll design. The grille around the tomb of Eleanor of Castille in Westminster Abbey, made in about 1294 by a craftsman named Thomas de Leghstone, employed a then new technique using die-stamps for the raspberrylike terminals. The most imposing of all tomb grilles, and perhaps the finest piece of English Gothic ironwork, is on the tomb of Edward IV in Saint George's Chapel at Windsor Castle. This ornate structure, resembling the facade of a cathedral, was created late in the 15th century by one John Tresilian.

In the 14th and 15th centuries, French and German ironworkers developed to a peak the art of chiseling iron to adorn locks, door knockers, and caskets with cutwork Gothic ogee arches and quatrefoils. Until the 16th century, Italian smiths relied instead on hammer and anvil for



Silhouetted against sunlight are the massive wrought-iron gates of the ducal castle at Darmstadt, Germany.

German Information Center

their effects, as in the pointed arches of the chancel screen in the Church of Santa Croce in Florence, dating from about 1371. Iron balconies, often with interlocking quatrefoils, seem to have been introduced first in Venice.

The Renaissance in France and England scarcely affected the Gothic style that was favored by local smiths, who limited themselves mainly to door furnishings. But in Germany and Spain vast new works were undertaken. In the 15th century, Spanish smiths excelled in making *rejas*, cathedral screens up to 30 ft. in height and consisting of forged balusters with friezes of

hammered arabesque ornamentation. Good examples are in Seville and Barcelona. German smiths of the 16th and 17th centuries used iron abundantly for door furnishings, screens, and gates, and for distinctive grave crosses formed by interlaced circular bars, often with petaled flower finials.

European smiths of the late 17th and 18th centuries flourished as production methods improved and demand grew. In England Jean Tijou (fl. 1688-1712), a French Huguenot refugee, designed the gates and screens of Hampton Court Palace (about 1690), remarkable for their lavish swags, scrolls, embossed satyr- and animal-headed masks, and floral ornamentation. The fountain screen, in particular, suggests courtly magnificence; its swirling and entangled patterns are topped by decoration fashioned to resemble drapery. Tijou also made gates, balconies, and other works at Oxford and Stamford, and the railings in Saint Paul's Cathedral in London are from his forge. Tijou's influential book of designs, published in 1693, popularized such motifs as intertwined initials in monograms. Original ironwork, dormant for two centuries in England, revived under his influence; it has never surpassed him since.

In France the art of the ironsmiths was more elaborate than that of English craftsmen; it reached a peak of complexity at the palaces of Fontainebleau, Chantilly, and Versailles. Iron gates and fences became standard features of the landscaped 18th-century garden, as were staircase balusters in the house and such domestic implements as trivets, cranes, and toasters. In America iron was used widely, especially in areas of French and German settlement such as Louisiana and Pennsylvania. The Vieux Carré section of New Orleans is noted for its beautiful iron porches and balconies, mostly wrought-iron structures with cast-iron ornaments.

Late in the 18th century the less expensive cast iron usurped many of the practical uses of wrought iron. Utensils and ornaments could be cast in quantity, while mechanization could do little for wrought iron, which necessarily involved patient work by human hands. Nineteenth-century Art Nouveau gates and railings used cast iron almost exclusively. Only toward the end of the 19th century did the English arts and crafts movement begin to revive ironworking. Design, however, was eclectic and unoriginal until the advent of Edgar Brandt (b. 1880) of Paris in the 1920's. His Art Deco designs for lamps and doors gave wrought iron a texture similar to beaten silver.

Iron gates and grilles were often included in

designs for the many public buildings and large residences constructed in the 1920's. The American ironsmith and teacher Samuel Yellin (1885-1940) contributed notable doors and grilles for banks and other monumental buildings. In more recent times wrought iron has once again lost favor with all but a few wealthy patrons and builders, although as a craft iron-working retains its fascination.

WRYNECK, common name applied to birds of the genus *Jynx*, belonging to the family Picidae, which also includes the woodpeckers (see **WOODPECKER**). Unlike the woodpeckers, the wryneck has a rounded tail of soft feathers. The best-known species, *J. torquilla*, inhabits Europe and Asia, is 7 in. long, and has rusty ash plumage, mottled with black and brown. The food of the wryneck consists largely of caterpillars and insects, and it is often seen on the ground near anthills feeding on ants. The wryneck nests in the natural hollows of trees, where it lays six to ten eggs in a clutch. One other species of wryneck is found in central and southern Africa. The name wryneck is derived from its habit of twisting its head and neck with a quick, undulating motion.

WUCHANG, former city of China, now a part of Wuhan (q.v.) or the Han Cities, at the confluence of the Yangtze and Han rivers, opposite Hankow (q.v.) and Hanyang. The Canton-Peking Railroad, principal artery of communication between N. and S. China, has its terminus in Wuchang. Industries include silk and cotton weaving, steel works, tanning, tea growing, food processing, and paper manufacturing. Wuchang is an educational center, and its institutions of higher learning include Wuhan University, Hupei Medical College, Central China Institute of Agriculture, Central China Normal College, and the Central China Engineering Institute.

The oldest of the Han group, Wuchang is a walled city that was important before the birth of Christ. It was the capital of the ancient kingdom of Chu in 300 B.C. and of the kingdom of Wu in the 3rd century of the Christian era. Wuchang became the capital of Hupei Province in the 17th century. It was the scene of the Wuchang Uprising on Oct. 10, 1911, that led to the overthrow of the Manchu dynasty and the establishment of the Chinese republic. It was made an independent municipality in 1935, and was later incorporated into Wuhan.

WUHAN, city in the People's Republic of China, and capital of Hupei Province, at the confluence of the Han and Yangtze rivers, about 450 miles W. of Shanghai. Its name is a composite of those of its component parts, the former cities

of Hankow, Wuchang (qq.v.), and Hanyang. Often called the Han Cities, they form an administrative unit but retain their identities as individual communities. Wuhan is the principal industrial and commercial center of central China. Among the leading manufacturing establishments are iron and steel works, textile mills, and food-processing plants. Pop. (1970 est.) 4,250,000.

WUHSIEN. See SOOCHOW.

WUHU, city and port of the People's Republic of China, in Anhwei Province, on the Yangtze R., about 60 miles S.S.W. of Nanking. It is a commercial and industrial center linked by canals with the hinterland and possessing a harbor accessible to ocean shipping. The leading industries are cotton and silk weaving, egg processing, flour milling, and tanning. Valuable articles of trade include rice, cotton, tea, wheat, and lumber. Coal and iron are mined in the vicinity. Wuhu is a walled city. It was opened to foreign trade in 1877. Pop. (1970 est.) 300,000.

WULFENITE, or **YELLOW LEAD ORE**, transparent or subtranslucent mineral, consisting of lead molybdate, $PbMoO_4$, and crystallizing in the tetragonal system; see **CRYSTAL**. It was named in honor of the Austrian botanist and mineralogist Franz Xaver von Wulfen (1728-1805). It has a hardness (q.v.) of 2.75 to 3.0, sp.gr. 6.7 to 7.0, and shines with a vitreous to adamantine luster. The color of the mineral ranges from yellow, orange, red, and gray, to white, most specimens being streaked with white. Wulfenite occurs chiefly in the oxidized portions of lead veins, together with such minerals as vanadinite and pyromorphite. The principal deposits of wulfenite are in the United States, in Utah, Nevada, New Mexico, Arizona, and Pennsylvania. The mineral is a principal source of molybdenum (q.v.).

WULFILA. See ULFILAS.

WUNDT, Wilhelm Max (1832-1920), German psychologist, born in Neckarau (now part of Mannheim), and educated at the universities of Tübingen and Heidelberg, and the Institute of Physiology in Berlin. After teaching physiology at the University of Heidelberg (1858-74), he taught inductive philosophy at the University of Zürich (1874-75). He became professor of philosophy at the University of Leipzig from 1875 to 1917. Generally recognized as the founder of scientific psychology as an independent discipline, Wundt offered in 1862 the first academic course in psychology and established the first laboratory for experimental psychology in 1879; see **PSYCHOLOGY**, **EXPERIMENTAL**. He founded the first psychological journal, *Philosophische Studien* ("Studies in Philosophy"), in 1881. He pro-

WUPATKI NATIONAL MONUMENT

moted what is known as structuralist or content psychology, emphasizing observations of the conscious mind rather than inference. Wundt also carried out extensive experimental research on perception, feeling, and apperception. His more than 500 published works include *Grundzüge der Physiologischen Psychologie* (2 vol., 1873-74; Eng. trans., *Principles of Physiological Psychology*, 1904) and *Völkerpsychologie* (10 vol., 1900-20). The last-named monumental work was issued in part in English as *Elements of Folk Psychology* (1916). He also wrote *Logik* (1880), *Ethik* (1886), and *System der Philosophie* (1889).

WUPATKI NATIONAL MONUMENT, area of historic interest, in Arizona, 25 miles N.E. of Flagstaff. It preserves the red sandstone ruins of Indian pueblos built into black basaltic cliffs adjoining the Little Colorado R. and the Painted Desert (q.v.). More than 800 dwellings of a prehistoric farming culture have been discovered here. It is believed that the dwellings were built in the 11th or 12th century, possibly by ancestors of the Hopi (q.v.). See also PUEBLO: *Archeology and Prehistory*. The monument is administered by the National Park Service (q.v.).

WUPPERTAL, city of West Germany, in North Rhine-Westphalia State, on the Wupper R., 17 miles E. of Düsseldorf. Industries include dyeing and bleaching, brewing, food processing, and the manufacture of iron and steel, machinery, vehicles, rubber and electrical products, textiles, rugs, apparel, lace and ribbon, pianos and organs, chemicals, pharmaceuticals, and paper. Wuppertal is the center of the area known as the Bergische Land. Features of the city include the Schwebebahn (1903), an 8-mi. interurban railway that is suspended over the river, the Bismarck and Toelle towers on wooded heights above the city, the Hardt Gardens (botanical), Barmen Gardens, and a zoo, stadium, city museum, opera house, and theater. The city was created in 1929, combining Barmen, an insurance center, with Elberfeld, Cronenberg, Ronsdorf, Vohwinkel, and Beyenburg. Pop. (1970) 417,700.

WÜRTTEMBERG, former State of Germany, bounded on the N.E. and E. by the State of Bavaria, on the S.E. by Bavaria and the Lake of Constance, which separated the area from Switzerland, and on the S.W., W., and N.W. by the former State of Baden. The capital of the State was Stuttgart.

Occupied originally by the Celts (see CELTIC PEOPLES AND LANGUAGES) and Suevi (q.v.), the Württemberg region was conquered in the 1st century by the Romans. In the 3rd century it was

overrun by the Alamanni, who in turn were subdued by the Franks (qq.v.). The Frankish emperors organized the area as part of the duchy of Swabia (q.v.), and in or before the 13th century gave the title of counts of Württemberg to a local family. The counts became increasingly powerful, and in 1495 Württemberg was raised to the rank of a duchy. The area became Protestant during the 16th century and was ravaged during the Thirty Years' War (q.v.). Despite the effects of war and occasional misrule, Württemberg began to develop as a manufacturing and textile center by the late 17th century.

In 1803 the dukes of Württemberg were raised to the rank of electors, and in 1806 to kings. The kingdom was granted a constitution in 1819. Württemberg was allied with Austria against Prussia in 1866, during the Seven Weeks' War (q.v.). Nevertheless it joined the Prussian-dominated North German Confederation (q.v.) in 1867. The kingdom supported Prussia against France in 1870 and in 1871 became part of the new German Empire.

After World War I the reigning king was forced to renounce the throne, and a republican constitution was adopted on Sept. 25, 1919. Although the constitution was a success, most government powers were surrendered to the Third Reich in 1934. During World War II Württemberg was taken by American and French forces. After the war it was divided between the newly created States of Württemberg-Baden (United States zone of occupation) and Württemberg-Hohenzollern (French zone of occupation). Both States became parts of the Federal Republic of Germany in 1949. Following popular approval in a plebiscite, these States merged in 1952 with the State of Baden to form the new State of Baden-Württemberg (q.v.).

WURTZ, Charles Adolphe (1817-84), French chemist, born in Strasbourg, and educated at the universities of Strasbourg and Giessen. He taught organic chemistry in Paris and Versailles, served as dean of the medical faculty of the University of Paris from 1866 to 1875, and served as professor of organic chemistry in 1875. Wurtz is known for his researches in organic chemistry, especially for his work on compounds related to ammonia and glycol, and on aldol, a colorless aldehyde, and the process of aldolization. He was codiscoverer with the German chemist Rudolf Fittig (1835-1910) of the Wurtz-Fittig synthesis, a method of combining organic halogen compounds to form larger molecules. He also made valuable contributions to theories of the arrangements of atoms in organic compounds. His works include *Traité Élémentaire de Chimie*



The elaborate rococo facade of the House of Falcon in Würzburg.
German Information Center

Médicale (2 vol., 1864-65; Eng. trans., *Modern Chemistry*, 1885), *Dictionnaire de Chimie Pure et Appliquée* ("Dictionary of Pure and Applied Chemistry", 3 vol., 1868-78), and *Théorie Atomique* (1878; Eng. trans., *Atomic Theory*, 1880). **WÜRZBURG**, city of West Germany, in Bavaria, on both sides of the Main R., about 60 miles E.S.E. of Frankfurt. It is a railroad junction, an industrial center, and the commercial center of an agricultural region noted for its vineyards. The leading manufactures of the city include wine and beer, machinery, scientific instruments, paper, pianos, chemicals, bricks, lumber, lacquer, and textiles. There are numerous architectural landmarks in Würzburg, notably the Romanesque cathedral, Neumünster Church, and the Church of Saint Burkhard, all dating from the 11th century; the Gothic Chapel of Saint Mary, begun in 1377; a 15th-century stone bridge spanning the Main; the Marienberg fortress atop the Leistenberg, which was the episcopal residence from 1261 to 1720; the Julius hospital (founded 1576); and the rococo episcopal and ducal palace (1720-44). The city is the site of the University of Würzburg (1582). The German physicist Wilhelm Conrad Roentgen

(q.v.) discovered X rays in 1895 while he was a professor there.

Würzburg was founded probably in the 7th century and in 741 it became an episcopal see. In succeeding centuries the bishops of Würzburg were prominent also as temporal princes and their domains eventually had an area of about 1900 sq.mi. During the Napoleonic Wars (q.v.) the bishopric was secularized in 1801, assigned to Bavaria in 1803, and transferred to Ferdinand III, the dispossessed grand duke of Tuscany (1769-1824), in 1805. It was restored to Bavaria in 1815 by the Congress of Vienna; see VIENNA, CONGRESS OF. During World War II (q.v.) the city sustained extensive damage from air raids. Pop. (1970) 116,400.

WUSIH, city of the People's Republic of China, in Kiangsu Province, on the Grand Canal, on the N. shore of Tai Lake, 26 miles N.W. of Soochow. A former tin center, it is now an industrial city and the economic center of the Tai Basin, which produces rice, wheat, cotton, silk, and vegetables. Industries include rice and flour milling, cotton-textile weaving, food processing, vegetable-oil milling, and the manufacture of machinery, needles, and soap. Until the late 19th century Wusih was a walled market town on an island surrounded by the canal. The ex-

WYANDOT

panded city includes the provincial congress building, a palace of culture, the 16th-century Plum Tree Garden, and the Tortoise Head Park on a peninsula in the lake. Founded under the ancient Han dynasty, it was the capital of South Kiangsu Province from 1949 to 1954. The name is also spelled Wu-hsi. Pop. (1970 est.) 900,000.

WYANDOT, North American Indian tribe of the Huron (q.v.) confederation. Like other Huron, they originally inhabited what is now Ontario Province, Canada. Attacked by the Iroquois (q.v.), the Wyandot fled to what are now Detroit, Mich., and Sandusky, Ohio, in 1649. They fought with the French in the French and Indian War, sided with the British in the American Revolution, and divided their loyalties in the War of 1812. In 1842 the Wyandot sold their Michigan and Ohio lands and moved to Kansas; in 1867 they were placed on the Wyandotte reservation in Oklahoma where they still live. In the early 19th century the Wyandot numbered about 1250; today only several hundred Indians with any Wyandot blood survive.

WYANDOTTE, city of Michigan, in Wayne Co., on the Detroit R., 12 miles s.w. of Detroit. It has important chemical industries, raw materials for which are extracted from extensive, nearby salt deposits. Other industrial establishments produce nuts, bolts, gaskets, pipe fittings, cement, and screw machine products. A steel-analysis laboratory was established there in 1862, and the first Bessemer steel commercially produced in the United States came out of furnaces in Wyandotte in 1864. The community was settled in 1814 on the site of a Wyandot (q.v.) Indian village. It was incorporated as a village in 1854 and as a city in 1866. Pop. (1960) 43,519; (1970) 41,061.

WYANDOTTE CAVE, natural limestone cave of Indiana in Crawford Co., about 25 miles w. of Louisville, Ky. Its underground passages and chambers total more than 23 mi. in length, making it the third-largest cave (after Carlsbad Caverns and Mammoth Cave) in the United States. Wyandotte Cave has an extraordinary variety of spectacularly shaped stalactites and stalagmites, notably an enormous, white, cylindrical stalagmite known as the "Pillar of the Constitution".

WYATT, Sir Thomas or **WYAT, Sir Thomas** (1503?-42), English poet and diplomat, born near Maidstone, and educated at the University of Cambridge, graduating in 1518. Six years later he was engaged by Henry VIII (q.v.), King of England, to fulfill various offices at home and abroad. Wyatt was knighted in 1537 and served from 1537 to 1539 as ambassador to the court of Charles V (q.v.), Holy Roman Emperor.

Wyatt is credited with introducing the sonnet (q.v.) into English poetry; he translated ten sonnets by the 14th-century Italian poet Petrarch (q.v.), composed original sonnets, and worked in other poetic forms, such as the lyric, song, and rondeau (qq.v.). His best-remembered works are the poems that deal candidly with the trials of romantic love, but he also wrote three highly regarded satires (see SATIRE) in terza rima (q.v.) and a metrical translation of the penitential psalms (q.v.), which was posthumously published in 1549 as *Certayne Psalmes*. Wyatt's poetry first appeared in an anthology, *The Book of Songes and Sonnettes* (1557).

WYCHERLEY, William (1640?-1716), English dramatist, born in Clive, Shropshire. After a stay of several years in France he studied at the University of Oxford, but without matriculating or taking a degree, and at the Inner Temple in London, where his interests were more literary than legal. His first comedy, *Love in a Wood*, produced in London in 1671, won him the patronage of Barbara Villiers, Duchess of Cleveland (1641-1709), the mistress of the English king Charles II (q.v.). He then produced three more scandalous comedies, all reflecting the ruthless mores of a profligate age: *The Gentleman Dancing-Master* (1672 or 1673), *The Country Wife* (1672 or 1673), and *The Plain Dealer* (1675). Wycherley's plays are characterized by exuberant, often bawdy, humor, witty dialogue, and solid construction. The three earlier plays are stylized, somewhat artificial portraits of foppish London gallants and ladies of fashion. In *The Plain Dealer*, however, he introduced a serious, satirical view of London society that verged on moralism.

Wycherley lost the king's patronage in 1680 when he married a wealthy widow. Upon her death a year later, Wycherley became involved in litigation over her estate. He spent seven years in debtors' prison, being finally released through the intervention of King Charles' successor, James II (q.v.), who paid his debts and granted him a small pension.

See **DRAMA**: *National Drama*: *England*.

WYCLIFFE, John or **WICLIFF, John** (1329?-84), English theologian and religious reformer, born in Hipswell, Yorkshire, and educated at Balliol College, University of Oxford. He received a doctorate in theology in 1372. The so-called Morning Star of the Reformation, whose surname is also spelled Wyclif or Wickliffe, he taught philosophy at Oxford throughout most of his career, while nominally serving as a priest in a succession of parishes. Wycliffe gained prominence in 1374 during a prolonged



The remains of John Wycliffe are disinterred and burned and the ashes thrown into the river (wood engraving from an 1832 U.S. edition of John Foxe's The Book of Martyrs).

Granger Collection

dispute between Edward III (q.v.), King of England, and the papacy over the payment of certain papal tribute. Both king and Parliament were reluctant to pay the papal levies. Wycliffe wrote several pamphlets refuting the pope's claims and upholding the right of Parliament to limit church power. King Edward appointed him to a commission that in 1375 conferred with papal representatives at Bruges, Belgium, on the differences between the crown and the papacy. The conference failed, but Wycliffe won the patronage of John of Gaunt (q.v.), fourth son of King Edward and leader of an antipapal faction in Parliament.

Attack on Church Authority. In 1376 Wycliffe enunciated the doctrine of "dominion as founded in grace", according to which all authority is conferred directly by the grace of God and is consequently forfeited when the wielder of that authority is guilty of mortal sin; see GRACE; SIN. Wycliffe did not state explicitly that he considered the English church to be sinful and worldly, but his implication was clear. On Feb. 19, 1377, he was called before the bishop of London, William Courtenay (1342?-96), to give account of his doctrine. The interrogation ended when John of Gaunt, who had accompanied Wycliffe, became involved in a brawl with the bishop and his entourage. On May 22, 1377, Pope Gregory XI (1331-78) issued several bulls

accusing Wycliffe of heresy (q.v.). In autumn of the same year, however, Parliament requested his opinion on the legality of forbidding the English church to ship its riches abroad at the pope's behest. Wycliffe upheld the lawfulness of such a prohibition, and early in 1378 he was again called before Bishop Courtenay and the archbishop of Canterbury, Simon of Sudbury (d. 1381). Wycliffe was dismissed with only a formal admonition, however, because of his influence at court.

During 1378 Wycliffe and certain Oxford associates defied church tradition by undertaking an English translation of the Vulgate (q.v.), or Latin Bible; see BIBLE, ENGLISH TRANSLATIONS OF THE.

The Poor Preachers. In 1379 Wycliffe repudiated the doctrine of transubstantiation (q.v.). This bold declaration caused such a furor that John of Gaunt withdrew his support. Standing his ground, Wycliffe in 1380 began to send out disciples, called Poor Preachers, who traveled the countryside expounding his equalitarian religious views. The preachers found a ready audience, and Wycliffe was suspected of fomenting social unrest. He had no direct connection with the unsuccessful Peasants' Revolt in 1381, but it is probable that his doctrines influenced the peasants; see TYLER'S REBELLION. In May, 1382, Courtenay, now the archbishop of Canterbury, convened an ecclesiastical court that condemned Wycliffe as a heretic and brought about his expulsion from Oxford. Wycliffe retired to his parish of Lutterworth.

His Teachings. After Wycliffe died in 1384, his teachings were spread far and wide. His Bible, which appeared in 1388, was widely distributed by his followers, called Lollards (q.v.). Ultimately Wycliffe's writings strongly influenced the Bohemian religious reformer John Huss (q.v.) in his revolt against the church. The German reformer Martin Luther (q.v.) also acknowledged his great debt to Wycliffe. In May, 1415, the Council of Constance reviewed Wycliffe's heresies and ordered his body disinterred and burned; see CONSTANCE, COUNCIL OF. This decree was carried out in 1428.

In its most developed form, Wycliffe's philosophy represented a complete break with the church. He believed in a direct relationship between man and God, without priestly mediation. By a close adherence to the Scriptures, Christians could, Wycliffe believed, govern themselves without the aid of popes and prelates. Wycliffe denounced as unscriptural many beliefs and practices of the established church. He held that the Christian clergy should strive to imitate evangelical poverty, the poverty of Christ and his disciples. Finally, Wycliffe disavowed serfdom (q.v.) and warfare.

See also CHURCH OF ENGLAND; ENGLAND: *History: Origins of Parliament*; REFORMATION; ROMAN CATHOLIC CHURCH.

WYE, Great Britain, river of E. Wales and W. England. It rises on Plynlimmon Mt., Montgomeryshire, Wales, flows 130 mi. in a southeasterly direction, and empties into the estuary

of the Severn R. 2 mi. below Chepstow. The tide sometimes rises 46 ft. at its mouth, above which the river is navigable by small vessels for 15 mi. The lower course of the Wye is noted for its scenic beauty; the ruins of Tintern Abbey (q.v.) are on the W. bank 9 mi. below Monmouth.

WYETH, Andrew Newell (1917-), American genre painter, born in Chadds Ford, Pa., and trained by his father, the American illustrator and muralist Newell Convers Wyeth (1882-1945). Andrew Wyeth held his first one-man show at the age of twenty and scored an immediate success; since then he has exhibited regularly. His media are chiefly watercolor and tempera. In his compositions, interpretations mainly of the people and landscapes of Pennsylvania and Maine, he displays technical brilliance, realism, and affection for his subjects. Among Wyeth's best-known works are "Christina's World" (1948, Museum of Modern Art, New York City) and "Her Room" (1963, Farnsworth Museum, Rockland, Maine). Elected to the National Academy of Design and the American Academy of Arts and Letters in 1955, Wyeth received the United States Presidential Medal of Freedom in 1963. In 1970 Wyeth became the first living artist to be accorded an exhibition in the White House. His son, James Browning Wyeth (1946-), is also an artist.

WYKEHAM, William of or WICKHAM, William of (1324-1404), English prelate and statesman, born in Wickham, Hampshire, and educated at a grammar school in Winchester. In



"Miss Olson", a painting (1952) by Andrew Wyeth.

Whitney Museum of American Art

1367, after advancing in the service of the English king Edward III (q.v.), he was consecrated bishop of Winchester and in 1368 was made lord chancellor of England. In 1371 a wave of anticlerical feeling forced him to resign as lord chancellor. He was deprived of his ecclesiastical and other temporal offices in 1373 because of his opposition to the anticlerical policies of the king's son John of Gaunt (q.v.). In 1377, on the accession of King Richard II (q.v.), Wykeham was pardoned, and many of his preferments were restored. He subsequently devoted a large part of his personal fortune to the relief of indigent English scholars. To that end, he founded and endowed New College of the University of Oxford in 1379 and the affiliated preparatory school, Saint Mary's College of Winchester, in 1382. He served again as lord chancellor from 1389 to 1391, when he retired. Remembered chiefly as a patron of education, he has been called the "father of the English public-school system".

WYLER, William (1902-), American motion-picture director and producer, born in Mulhouse, France (then under German administration), and educated at the École Supérieure de Commerce in Lausanne, Switzerland, and at the National Conservatory of Music in Paris. He came to the United States in 1920 and spent the next several years at Universal Pictures learning all phases of film making. In 1925 he directed his first motion picture, a two-reel Western. Three years later he became a U.S. citizen. By 1935 Wyler was a well-known director of light comedies.

Most of the motion pictures that Wyler later directed were based on important novels and plays. His adaptation of *Wuthering Heights*, by the British novelist Emily Brontë (see BRONTË), won the New York Film Critics' Award as the best motion picture of 1939. Wyler later received numerous major cinema prizes, among them awards from the Academy of Motion Picture Arts and Sciences, popularly called Oscars, for directing *Mrs. Miniver* (1942), *The Best Years of Our Lives* (1946), and *Ben-Hur* (1959); and the Golden Palm Leaf at the 1957 Cannes (France) Film Festival for *Friendly Persuasion* (1956). In 1976 Wyler was given the life achievement award of the American Film Institute.

Variety of subject matter and range of type (from serious melodrama to musical comedy) characterize Wyler's films. Others outstanding among them are *Jezebel* (1938), *The Little Foxes* (1941), *Detective Story* (1951), *Roman Holiday* (1953), *The Children's Hour* (1962), *The Collector* (1965), *Funny Girl* (1968), and *The Liberation of L. B. Jones* (1970).

WYLIE, Philip (Gormon) (1902-71), American writer, born in Beverly, Mass. He attended Princeton University from 1920 to 1923, then worked at various odd jobs until 1925, when he joined the editorial staff of *The New Yorker* magazine. In the 1930's he wrote screenplays for several Hollywood studios, produced a syndicated newspaper column, contributed numerous short stories and articles to popular major periodicals, and traveled extensively in Europe and the Soviet Union.

After the publication of his first novel, *Heavy Laden* (1928), Wylie wrote novels, essays, and short stories at a prolific rate. His most-discussed books, *A Generation of Vipers* (1942), *Essay on Morals* (1947), and the novel *Opus 27* (1949), reflect his interest in psychological analysis. In these works he surveys and sharply criticizes ills and sentimentalized values in American society. The term "momism", referring to the sentimentalization of mother in American life, was first popularized by Wylie in *A Generation of Vipers*. *Sons and Daughters of Mom* (1971) is a criticism of youth today.

WYOMING, one of the Mountain States of the United States, bounded on the N. by Montana, on the E. by South Dakota and Nebraska, on the S. by Colorado and Utah, and on the W. by Utah and Idaho. Wyoming is almost square in shape, measuring about 356 mi. from E. to W. and about 278 mi. from N. to S.

Area (9th State in rank)	97,914 sq. mi.
Land	97,203 sq. mi.
Inland water	711 sq. mi.
Population	(1970, 49th in rank) 332,416
	(1960, 48th in rank) 330,065
	(1950) 290,529
Altitude	3100 ft. to 13,804 ft.
Capital and largest city	Cheyenne (1970) 40,914
Entered Union (44th State)	July 10, 1890
Nickname	The Equality State
Motto	Equal Rights
Tree	cottonwood
Flower	Indian paintbrush
Bird	meadowlark

THE LAND

The surface of Wyoming consists of two general divisions: a highly elevated plateau in the N.E., composed chiefly of rolling plains, and, occupying most of the remainder of the State, ranges of the Rocky Mts. system. The general altitude of the mountain area is very high; only a few small valleys lie below 4000 ft., vast plateaus between the ranges lie between 6000 and 7000 ft., and many of the mountain peaks reach almost 14,000 ft. The Rockies cross Wyoming from S.E. to N.W. in two connecting chains. The more easterly chain enters the State near the S.E. corner. As the Laramie Mts. (q.v.), it extends N. for about 100 mi. to Laramie Peak; it then turns W. and then N. again and, as the Bighorn Mts. (q.v.),

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Hamilton Dome	B 2	Shoshoni	C 2
Hanna	C 3	Sinclair	C 3
Hawk Springs	D 3	South Superior	B 3
Hudson	B 2	Story	C 1
Hulett	D 1	Sundance	○	D 1
		Sunrise	D 2

○ County seat.

Superior	B 3
Ten Sleep	C 1
Thayne	A 2
Thermopolis ○	B 2
Torrington ⊙	D 2
Ucross	C 1
Upton	D 1
Wamsutter	C 3
Wheatland ⊙	D 2
Worland ⊙	C 1

Physical Features

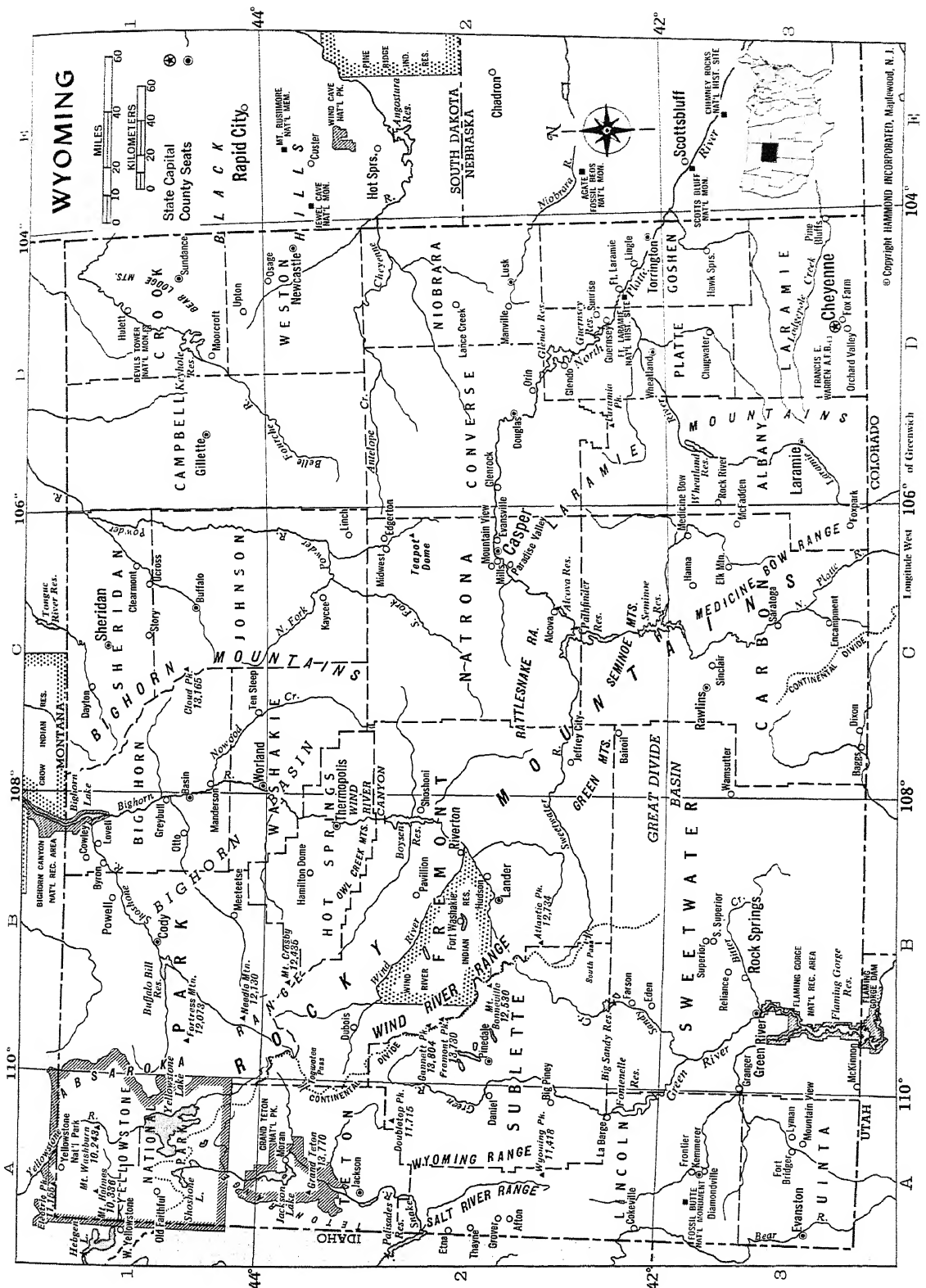
Absaroka (range)	B 1	Grand Teton Nat'l Park	A 2
Alcova (res.)	C 2	Great Divide (basin)	C 2
Antelope (creek)	D 2	Green (mts.)	C 2
Atlantic (peak)	B 2	Green (river)	B 3
Bear (river)	A 3	Guernsey (res.)	D 2
Bear Lodge (mts.)	D 1	Holmes (mt.)	A 1
Belle Fourche (river)	D 2	Jackson (lake)	A 2
Bighorn (basin)	B 1	Keyhole (res.)	D 1
Bighorn (lake)	B 1	Laramie (mts.)	D 2
Bighorn (mts.)	C 1	Laramie (peak)	D 2
Bighorn (river)	B 1	Laramie (river)	D 3
Bighorn Canyon Nat'l Rec. Area	B 1	Lodgepole (creek)	D 3
Big Sandy (res.)	B 2	Medicine Bow (range)	C 3
Bitter (creek)	B 3	Needle (mt.)	B 1
Black (hills)	E 1	North Fork (Powder) (river)	C 2
Bonneville (mt.)	B 2	North Platte (river)	D 2
Boysen (res.)	B 2	Nowood (creek)	C 1
Buffalo Bill (res.)	B 1	Owl Creek (mts.)	B 2
Cheyenne (river)	D 2	Palisades (res.)	A 2
Cloud (peak)	C 1	Pathfinder (res.)	C 2
Crosby (mt.)	B 2	Powder (river)	C 2
Devils Tower Nat'l Mon.	D 1	Rattlesnake (range)	C 2
Doubletop (peak)	A 2	Rocky (mts.)	B 2
Flaming Gorge (res.)	B 3	Salt River (range)	A 2
Flaming Gorge Nat'l Rec. Area	B 3	Sandy (creek)	B 2
Fort Laramie Nat'l Hist. Site	D 2	Seminole (mts.)	C 2
Fortress (mt.)	B 1	Seminole (res.)	C 2
Fossil Butte Nat'l Mon.	A 3	Shoshone (lake)	A 1
Francis E. Warren A.F.B.	D 3	Shoshone (river)	B 1
Fremont (peak)	B 2	Snake (river)	A 2
Gannett (peak)	B 2	South (pass)	B 2
Glendo (res.)	D 2	South Fork (Powder) (river)	C 2
Grand Teton (peak)	A 2	Sweetwater (river)	B 2
		Teapot Dome (mt.)	C 2
		Teton (range)	A 2
		Togwotee (pass)	B 2
		Washburn (mt.)	A 1
		Wheatland (res.)	D 3
		Wind (river)	B 2
		Wind River (canyon)	B 2
		Wind River (range)	B 2
		Wind River Ind. Res.	B 2
		Wyoming (peak)	A 2
		Wyoming (range)	A 2
		Yellowstone (lake)	A 1
		Yellowstone (river)	A 1
		Yellowstone Nat'l Park	A 1

continues into Montana. The second chain enters Wyoming in the south-central part of the State as the Medicine Bow and Sierra Madre ranges, which are separated by the North Platte R. valley. The two ranges merge and turn w as the Ferris Mts and then the Green Mts. The Green Mts. range turns n. and rises as the Wind River Range (q.v.), which, in turn, merges with the Absaroka and Owl Creek mountains. Another mountain group, the Teton Range, is situated s. of Yellowstone National Park in the n.w. corner of Wyoming. The highest point in the State is Gannett Peak (13,804 ft.) in the Wind River Range; the lowest point is along the Belle Fourche R. (3100 ft.) in the extreme n.e. The average elevation of the State, 6700 ft., is the second highest in the U.S.; only that of Colorado is higher. The plateau region of Wyoming is treeless and dotted with occasional buttes.

Rivers and Lakes. The continental divide crosses Wyoming from the n.w. to the south-central region. Rivers rising e. of the divide are tributaries of the Missouri R. Among these are

the North Platte R. and its tributaries, which drain the largest area of the State, flowing n. to central Wyoming and s. and s.e. to Nebraska. The Bighorn and Powder rivers flow n. into Montana. West of the divide the Green R. flows s. into Utah, joining the Colorado R. The Snake R. flows s.w. into Idaho and Washington, where it joins the Columbia R. Among the several natural lakes in Wyoming is Yellowstone Lake, in Yellowstone National Park, the largest body of water at so great an altitude in North America. Shoshone Lake is also in the park. Wyoming has many artificial lakes, including Flaming Gorge Reservoir, partly in Utah, on the Green R., Palisades Reservoir, partly in Idaho, on the South Fork of the Snake R., Alcova, Pathfinder, Seminole, and Glendo reservoirs on the North Platte R.; Boysen and Yellow Tail reservoirs on the Bighorn R., Buffalo Bill Reservoir on the Shoshone R., and Keyhole Reservoir, on the Belle Fourche R.

Climate. Wyoming has a continental type of climate, with long, cold winters and short, hot



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summers. Low humidity, however, mitigates both extremes. The highest temperature recorded in the State was 114° F. (at Basin); the lowest, -63° F. (at Moran). Precipitation varies across the State, the maximum falling in spring and early summer. At high elevations rainfall averages 7 to 10 in. annually; at lower elevations,

Climate	Casper	Cheyenne	Sheridan
Normal temperatures (in ° F.)			
January maximum	33.6	38.2	33.5
January minimum	12.7	14.9	8.5
July maximum	87.1	83.7	86.1
July minimum	54.9	54.5	54.6
Annual	45.4	45.9	45.0
Normal precipitation (in inches)			
Wettest month	1.94	2.52	2.99
Driest month	.49	.35	.69
Annual	11.22	14.65	16.16
Latest frost	May 18	May 20	May 21
Earliest frost	Sept. 25	Sept. 27	Sept. 21
Mean number of days between latest and earliest frosts	130	130	123

from 12 to 16 in. Annual snowfall averages from 60 to 70 in. in the e., 45 to 55 in. in the s.w., and well over 200 in. in the higher mountains. The average annual number of days with measurable

precipitation ranges from 89 at Casper to 101 at Cheyenne and 107 at Sheridan. Hailstorms are relatively frequent, but tornadoes are rare.

Plants and Animals. The plateau region of Wyoming supports numerous varieties of grasses. In the few forested areas the principal trees are lodgepole pine, ponderosa pine, Engelmann's spruce, and Douglas and white fir. Other trees include the cottonwood, found along streams, the quaking aspen, maple, birch, and low-growing willows. During spring and early summer wild flowers including columbine and bleeding heart bloom in profusion throughout the State. Wyoming has a number of indigenous large mammals, including the pronghorn antelope, white-tailed and mule deer, wapiti (elk), moose, bighorn sheep, and black and grizzly bears. Wildlife also includes the lynx, mountain lion, coyote, bobcat, beaver, muskrats, striped skunk, white-tailed jackrabbit, pocket gophers, and black-tailed prairie dog. The sage grouse is found in much of the State. Among other game birds are the ring-necked pheasant and Hungarian partridge, both introduced, and wild turkey. Many species of waterfowl, including the rare trumpeter and whistling swans, are found in Wyoming. The prairie rattlesnake, hog-

The Governor's Mansion in Cheyenne.

Wyoming Travel Commission





nose snake, and bull snake are common reptiles. Seven species of trout and fifteen other species of game fish occur in the rivers and lakes of the State.

Parks, Forests, and Other Places of Interest.

Grand Teton National Park (q.v.), in N.W. Wyoming, contains the most impressive peaks of the Teton Range. Yellowstone National Park (q.v.), also in the N.W., is the world's greatest geyser area. The Flaming Gorge Recreation Area, on

Grand Teton National Park in northwestern Wyoming offers vistas of breathtaking beauty.

Ansoo

the Colorado R. (partly in Utah), surrounds the reservoir of the same name. The Bighorn Canyon National Recreation Area surrounds a reservoir that extends for 47 mi.; it lies partly in Montana. Devils Tower National Monument (q.v.), in the N.E., was the first U.S. national monument, established in 1906. Fort Laramie Na-

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tional Historic Site (q.v.), in the s.e., contains buildings of the principal military post that guarded the covered-wagon trails to the w. The five national forests in Wyoming comprise more than 9,000,000 acres and contain mountain peaks, glaciers, innumerable lakes, wilderness areas, and spectacular views. They are, with headquarters city in parentheses, Bighorn (Sheridan), Bridger (Kemmerer), Medicine Bow (Laramie), Shoshone (Cody), and Teton (Jackson). Fossil Butte National Monument, on the Green R., contains fish fossils from 40,000 to 65,000 years old. John D. Rockefeller, Jr., Memorial Parkway traverses Grand Teton National Park to Yellowstone National Park. State parks include Big Sandy, in Sweetwater and Sublette counties; Boysen, in Fremont County; Buffalo Bill, in Park County; Glendo and Guernsey, in Platte County; Keyhole, in Crook County; and Seminoe, in Carbon County.

Sports. Wyoming offers a wide variety of fishing waters, from mountain streams to slow-moving rivers. Yellowstone National Park has excellent trout fishing. Other species of fish include grayling, Rocky Mountain whitefish, black bass, walleye, yellow perch, crappie, channel catfish, carp, and sunfish. Game animals and birds hunted are white-tailed and mule deer, black and grizzly bear, antelope, bighorn sheep, moose, elk, snowshoe hare, jackrabbit, wild turkey, sharp-tailed grouse, and chukar and Hungarian partridges. Wyoming offers a wide variety of ski facilities, including resorts at Medicine Bow, at Centennial; Happy Jack, near Laramie; Casper Mt., near Casper; and Ryan Park, near Rawlins. The Teton and Wind River ranges are of interest to experienced climbers. A mountain-climbing school is conducted in Grand Teton National Park, where beginners learn to climb on Mt. Owen (12,192 ft.), Mt. Moran (12,594 ft.), and Grand Mt. (13,766 ft.).

THE PEOPLE

According to the 1970 decennial census, the population of Wyoming was 332,416, an increase of 0.7 percent over the 1960 population. The urban segment comprised 201,111 persons, 60.5 percent of the total, compared with 56.8 percent in 1960. The rural segment comprised 131,305 persons, 39.5 percent of the total, compared with 43.2 percent in 1960. Ethnically, the 1970 population was distributed as follows: white persons, 323,024; nonwhites, 9392, including 4980 Indians, 2568 Negroes, and a sprinkling of Japanese, Chinese, Filipinos, and others. The percentage of native-born residents was 97.9; of foreign-born, 2.1. The major country of origin of the foreign-born was Great Britain. The 1970

population density averaged 3.4 per sq.mi., the same as in 1960.

The chief cities, in order of population, are Cheyenne, the capital and oldest city in the State, a railroad, airline, and distribution center; Casper, the commercial center of an oil and livestock region; Laramie, a manufacturing and trade center in a livestock and mining region, site of the University of Wyoming; and Sheridan, center of an agricultural area. The Shoshoni and Arapaho (qq.v.) tribes occupy the one Indian reservation in Wyoming, at Wind R. **Education.** The public-school system of Wyoming was established in 1869. Education is compulsory for all children between the ages of seven and sixteen.

ELEMENTARY AND SECONDARY SCHOOLS. In the early 1970's public elementary schools numbered about 215 and public secondary schools, about 115. Enrollment was about 45,700 pupils in elementary schools and about 39,700 in secondary schools. Teachers in the public-school system numbered about 2270 in elementary schools and about 2375 in secondary schools. In the early 1970's private institutions included about 20 elementary schools with some 3000 students, and about 5 secondary schools with some 500 students. Teachers in private schools numbered about 175 in the late 1960's. The State maintains four schools for exceptional children.

UNIVERSITIES AND COLLEGES. In 1970 Wyoming had eight institutions of higher learning, all public. University and college enrollment was about 15,400. The institutions are the University of Wyoming, Casper College, Sheridan College, Eastern Wyoming College, Western Wyoming Community College, Laramie County Community College, Northwest Community College, and Central Wyoming College.

Libraries and Museums. The Wyoming State Library, in Cheyenne, is a depository for Federal and Wyoming State documents; each county has at least one public library. Museums include the Wyoming State Museum and Art Gallery, in Cheyenne; the Buffalo Bill Historical Center, in Cody, in the Fort Fetterman historic restoration; the Fort Bridger Historical Landmark and Museum; and the University of Wyoming Geological Museum, in Laramie, noted for its fossil exhibits. The State has some fifty-five other museums containing Indian artifacts and pioneer relics, maintained by various historical and pioneer societies, the Federal government, and private individuals. The Wyoming State Archives and Historical Department, Museum and Art Gallery is in the State Office Building, in Cheyenne.



Agriculture in Wyoming. Above: A farmer on the Riverton irrigation project, in west-central Wyoming, harvests a crop of beans. Below: Workers place 8-in. tile pipes underground for drainage on a farm in the Riverton project.

Bureau of Reclamation



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THE ECONOMY

Wyoming has a diversified economy. Per capita personal income was \$6723 in 1976, compared with \$6441 for the U.S. as a whole. Agriculture employs about 9 percent of Wyoming's workers and mining engages about 10 percent. Nonagricultural workers are employed, in descending order of numbers, in government; wholesale and retail trade; service industries; construction; transportation and public utilities; manufacturing; and finance, real estate, and insurance. Most economic activities are based on the State's natural resources, including the manufacture of wood and petroleum products, the processing of food, and employment in the national parks and in tourist services.

Manufacturing. According to a recent survey of manufactures, production workers in Wyoming total about 5000. The largest numbers are employed in the manufacture of petroleum and coal products, food, and lumber and wood products. In the mid-1970's the annual value added by manufacture (see *VALUE*) in the largest industries was \$113,000,000 for petroleum and coal products, \$36,100,000 for food products, and \$23,300,000 for stone, clay, and glass products. The annual value added by all manufacturing in the State was about \$267,000,000.

Agriculture. Second only to mining in the Wyoming economy, agriculture is dominated by livestock production. The State's principal agricultural commodities (in order of cash receipts) are cattle, sugar beets, sheep, and wheat. Other important crops include hay and barley. About 15,800 people work on some 8000 farms covering about 35,400,000 acres; the average size of a farm is exceptionally large—4481 acres. In the mid-1970's total cash receipts from agriculture (including government payments) were about \$393,000,000 annually. Of this total, about \$303,000,000 was from livestock and \$83,000,000 from crops. The State was the nation's second leading producer of sheep and lambs, but ranked thirty-eighth in the U.S. in cash receipts from agriculture.

Mining. The principal industry of the State is mining. Its chief mineral products, in order of value, are petroleum, sodium compounds, coal, and natural gas. Wyoming ranked fifth in the U.S. in annual production of petroleum in the mid-1970's, with about 137,000,000 bbl. During that period the State ranked tenth in the U.S. in total value of mineral production, with annual production valued at about \$1.6 billion.

Energy. Generating plants in Wyoming, with a capacity of 3,400,000 kw, produced about 16.1 billion kw hours of electric energy annually in

the mid-1970's. About 7 percent of production and 9 percent of capacity were publicly owned. Dams and reservoirs on the major river systems of the West, the Missouri, Columbia, and Colorado, which rise in Wyoming, are among the sources of energy.

Forestry. The forest land of Wyoming consists predominantly of softwoods. The commercial forest land, primarily under public ownership, comprises about 4,200,000 acres. It produces a net annual cut of sawtimber of some 196,000,000 bd.ft.

Tourism. Wyoming is noted for pure air and abundant sunshine, and throughout the year it offers outdoor sports and recreational activities. There were almost 7,000,000 annual visitations to its four national parks in the mid-1970's and more than 1,000,000 visitations to its eight State parks and the Big Sandy recreation area. Wyoming has thirteen ski areas. Tourists contribute about \$311,000,000 to the economy each year.

Transportation. The first railroad in Wyoming was the Union Pacific Railroad, inaugurated in 1867. Today the State is served by 6 railroads with a total of 1778 mi. of track. Rural and municipal roads total about 32,600 mi.; Federally assisted primary and secondary highways total some 6500 mi., including about 915 mi. in the Interstate Highway System. The State is served by 1 international airline and 5 local or interstate airlines. There are about 42 public and 46 private airports.

Communications. The first newspaper in Wyoming was the *Daily Telegraph*, founded in Fort Bridger in 1863. Today the State has about 10 daily newspapers, 3 Sunday newspapers, and 28 weeklies. Among the leading papers are the Cheyenne *Wyoming Tribune-Eagle*, the Casper *Star-Tribune*, the Laramie *Boomerang*, and the Rock Springs *Rocket-Miner*. Of the 38 radio stations (29 AM and 9 FM) operating in the mid-1970's, among the oldest was KTWO (1930) in Casper. There were 3 television stations.

GOVERNMENT

Wyoming is governed under the constitution of 1889, as amended. Executive authority is vested in a governor and secretary of state, both elected for four-year terms; an attorney general appointed by the governor; and other elected and appointed officials. Legislative authority is exercised by the Senate, with thirty members elected for four-year terms, and the House of Representatives, with sixty-two members elected for two-year terms. The judicial system includes a four-member supreme court, district courts, and various local and special courts. The State is divided into twenty-three counties.

Wyoming is represented in the United States Congress by two Senators and one Representative.

Voting Qualifications. Suffrage is extended generally to U.S. citizens eighteen years of age who meet the residence requirements (one year in the State, sixty days in the county, and ten days in the election district).

HISTORY

The Canadian explorer Pierre Gaultier de Varennes, Sieur de La Vérendrye (q.v.), may have visited the region comprising present-day Wyoming in 1743. In 1803 the land east of the continental divide, except for a portion of what is now the southwestern corner of the State, was acquired by the United States from France as a part of the Louisiana Purchase (q.v.). The first white man definitely known to have entered the Wyoming region was John Colter (1775?-1813), a member of the Lewis and Clark Expedition (q.v.).

Early Exploration. Some accounts say he discovered (1807) the area occupied by present-day Yellowstone National Park. In 1811 the region was explored by members of a fur-trading expedition led by Wilson Price Hunt (1782?-1842), and in the following year some members of the same expedition returned to the region and, in all probability, discovered the South Pass through the mountains; the pass later became an important part of the Oregon Trail (q.v.). In 1824 Thomas Fitzpatrick (1799?-1854), the leader of another fur-trading expedition, used the South Pass, and by 1834, when Fort Laramie was built in eastern Wyoming, the pass was used by hundreds of fur traders, and the region beyond the continental divide had become the scene of an annual rendezvous for Indians, fur traders, and employees of the American Fur Company of John Jacob Astor (*see under* ASTOR). In 1842 Fitzpatrick led the first wagon train over the Oregon Trail. In 1846 the Oregon Treaty established the boundary between the U.S. and the Canadian possessions of Great Britain at the 49th parallel, as a result of which the northwestern corner of the Wyoming region, which had been part of the disputed Oregon Country, was relinquished by the British; *see* NORTHWEST BOUNDARY DISPUTE; OREGON: *History*.

U.S. Acquisition. In 1848 southwestern Wyoming was ceded to the U.S. by Mexico, after the Treaty of Guadalupe Hidalgo, ending the Mexican War. In 1849 the Oregon Trail became a major highway for the Forty-niners (q.v.), who were journeying to California. In 1850, as a result of the Compromise Measures of 1850 (q.v.), the southeastern corner of the present State of

Wyoming, along with other territories that belonged to Texas, was purchased by the U.S. from Texas for \$10,000,000. In 1851 the first stagecoach route was established through the State on the Oregon Trail, and by 1858 a daily stagecoach traveled through the region from Kansas to California. During the 1860's the sorties and depredations of the Sioux Indians, who had declared war against the whites in 1854, became increasingly greater. Peace was finally concluded with the Sioux (q.v.) in 1868. In the same year Wyoming was created as a territory. The following year Wyoming became the first political division in the nation and possibly in the world to grant the right of suffrage to women. The construction of the Union Pacific R.R. across the territory in 1867 and 1868, the discovery of gold in the same years, and the Homestead Laws (q.v.) stimulated settlement of the territory. In the ensuing years Wyoming became an important cattle-raising region. Settlers under the Homestead Laws came into conflict with the stockmen as a result of disputes over range land, and the disputes culminated in the Cattle War of 1892 in Johnson County, when a group of men representing the large stock owners invaded the county intending to fight the settlers on the pretext that the latter were rustlers, or thieves. Order was restored by a detachment of U.S. troops. Sheep raising had also become important in the territory, and conflict over grazing lands between cattle and sheep men persisted for a number of years, frequently resulting in bloodshed. In 1890 Wyoming was admitted to the Union as a State. It was the first State to have a woman governor when Mrs. Nellie Tayloe Ross (1876-1977) was elected to complete her deceased husband's term of office (1925-27).

From the start the underpopulated vastness of Wyoming has produced enormous wealth in agriculture, livestock, lumber, and oil. An already booming economy enjoyed redoubled growth with the post-World War II discovery of the minerals trona and uranium. In 1960 an important missile base was established in the Cheyenne area. In the 1970's water conservation has become a major issue. Faced with the projected diversion of the Green River to irrigate nearby States, Wyoming today plans to increase its water storage facilities and to build new dams and reservoirs.

WYOMING, city of Michigan, in Kent Co., on the Grand R., adjoining Grand Rapids on the s. and 4 miles s.w. of the downtown area. Manufactures include auto bodies, metal products, mobile homes, and electrical equipment. On the river is Indian Mounds Park, the site of an

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old burial ground; see MOUND BUILDERS. The first land grant was made in Wyoming Township in 1835, and the city was incorporated in 1958. Pop. (1960) 45,829; (1970) 56,560.

WYOMING VALLEY, valley of Pennsylvania, in Luzerne Co., extending along the N. branch of the Susquehanna R. A beautiful and fertile valley, it is about 21 mi. long and 3 mi. wide and is rich in anthracite coal. It is supposed to have derived its name from the Delaware Indian word Maughwauwama, meaning large plains. The valley was claimed by both Connecticut and Pennsylvania in colonial times, but was not settled until 1763, when the Susquehanna Company of Connecticut, which had purchased the land from the Indians in 1754, sent out a number of settlers. In 1768 Pennsylvania also bought the tract from the Indians and established a settlement (1769). Clashes ensued between the Connecticut and Pennsylvania settlers, the most serious of which were the first and second Penamite-Yankee Wars of 1769 to 1771 and 1775.

A more serious and tragic event in the history of the valley was the Wyoming massacre of July, 1778. In 1775, at the start of the American Revolution (q.v.), the settlers had expelled a few of their number who were Tories, being sympathetic to the British cause. In July, 1778, under the leadership of Colonel John Butler (q.v.), the expelled Tories, assisted by an additional British force and Indian allies, invaded the valley. The settlers took refuge in Forty Fort, near present-day Wilkes-Barre. On July 3, however, 400 of them, led by the American frontier soldier, Colonel Zebulon Butler (1731-95), attacked the invaders and were completely defeated; two thirds of them were killed or captured, and the rest again took refuge in the fort. Many of the prisoners were tortured and killed, and on the following day the fort was surrendered. A granite obelisk opposite Wilkes-Barre marks the site of the battle.

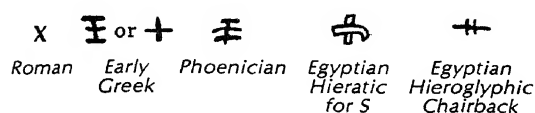
After the massacre, the surviving settlers returned to the valley in small numbers, and the old controversy between Connecticut and Pennsylvania was renewed. In 1782 the United States Congress decided in favor of Pennsylvania, but conflicts continued among the settlers

until 1788, when the Pennsylvania legislature confirmed their land titles.

WYSS, Johann Rudolf (1782-1830), Swiss writer, philosopher, and librarian, born in Bern, and educated at universities in Germany. In 1806 he was made professor of philosophy at Bern Academy, where he was subsequently appointed chief librarian. From 1810 to 1830 he also edited the Swiss literary almanac *Die Alpenrosen* ("The Alpine Rose"). Wyss is remembered chiefly for *Der Schweizerische Robinson* (1812; Eng. trans., *The Swiss Family Robinson*, 1820), a novel based on a story told to him during childhood by his father, Johann David Wyss (1743-1818), about a shipwrecked family. A juvenile classic, the work is imitative of the novel *Robinson Crusoe* (1719) by the British writer Daniel Defoe (q.v.). It possesses much independent merit, however, and is a perennial favorite among young people. Wyss gained fame also as the author of the Swiss national hymn "Rufst du, Mein Vaterland?" ("Are You Calling, My Fatherland?", 1811). He collected and popularized many ancient Swiss legends, chronicles, and folk songs.

WYTHE, George (1726-1806), American Revolutionary patriot and jurist, born near Yorktown, Va., and privately educated. A member (1754-55; 1758-68) of the Virginia House of Burgesses, in 1764 he drafted the protest of that body against the proposed Stamp Act (q.v.). Elected to the Continental Congress in 1775, he was one of the signers of the Declaration of Independence (qq.v.). Wythe was a member of the Federal convention of 1787, which framed the Constitution of the United States (q.v.). From 1779 to 1790 he was the first professor of law at the College of William and Mary. Among those who studied and worked under him were the American jurist John Marshall and the American statesmen Thomas Jefferson, James Monroe, and Henry Clay (qq.v.). Wythe was judge of the Virginia court of chancery from 1778 to 1786 and chancellor of the State of Virginia after 1786. One of the earliest American abolitionists (q.v.), he freed his own slaves and provided for them in his will. His writings include *Decisions in Virginia by the High Court of Chancery* (1795).

X, twenty-fourth letter and nineteenth consonant in the English alphabet. The form, phonetic value, and name of the letter are taken from Latin, which borrowed the letter from Chalcidian, a western Greek alphabet of the 7th century B.C. The Greek letter was based upon a Phoenician character, which in turn was derived from Egyptian hieratic and hieroglyphic characters. The history of the form of the letter may be summarized as follows:



The normal *x* sound in English, occurring in the name of the character itself, is a composite consonant sound with the phonetic value of *ks*; examples of this sound occur in the words *fixture*, *Styx*, and *excellent*. Between two vowels, the first of which is unaccented, the *x* sound is usually voiced, and may be represented by the composite consonant *gz*, as in *exalt* and *exhilarate*. An initial *x*, generally occurring in words of Greek origin, has a *z* sound, as in *Xerxes* and *xylophone*. Other *x* sounds occurring in English may be represented by the composite consonants *ksh* and *gzh*, as in *anxious* and *luxurious*, respectively.

As an abbreviation, the capital *X* stands for the words *Christ* and *Christian* (from its resemblance to the Greek letter [*chi*], the initial letter of the Greek word *Christos*, or *Christ*). The capital and lowercase forms of the letter are used in finance as an abbreviation for *ex*, which occurs in such compound forms as *ex dividend*. As a symbol, the capital *X* stands for the number 10 in Roman numerals; in the forms \times and \bar{X} it stands for 1000 and 10,000, respectively. Capital *X* is also used in physics as a symbol for electrical reactance. In all branches of mathematics, but especially in algebra, lowercase *x* is used to

symbolize an unknown quantity or variable, and in analytic geometry it signifies an abscissa (see *GEOMETRY, ANALYTIC*). The capital *X* is frequently used in compound words to indicate anything having the shape of the letter; it is also used as a symbol for a cross. The letter may be used to indicate the twenty-fourth or, if *J*, *V*, and *W* are not used, the twenty-first member of a series, class, group, or order.

M.P.

XANTHIPPE, wife of the Greek philosopher Socrates (q.v.).

XAVIER, Saint Francis (1506–52), Spanish Jesuit missionary, known as the "Apostle (q.v.) of the Indies", born near Pamplona, Navarre, and educated at the University of Paris. In 1529, while in Paris, he met the Spanish ascetic Ignatius of Loyola (q.v.). Xavier was one of the group that joined (1534) Ignatius to found the Society of Jesus. In 1537, the year he was ordained priest, Xavier became the first secretary of the Society of Jesus. See *JESUITS*; *MISSIONARY MOVEMENTS*.

Mission to India. He began his work in Portuguese India in 1542. After preaching with great success in Goa for five months he extended his labors to southern India and Ceylon, in which places he is credited with having made tens of thousands of converts.

In 1545 Xavier left India for Malacca and the next year began to travel through the islands of the Malay Archipelago, where he founded many Christian communities. Returning to Malacca in 1547, he received information from a Japanese exile that encouraged him to attempt to introduce Christianity into Japan. After a trip to Goa he sailed for Japan with the exile, a Jesuit priest, and a lay brother and landed at Kagoshima in 1549. He studied the Japanese language for a year and then preached in many of the principal cities. By 1551, when he left Japan, he had established a vigorous Christian community.

Mission to China. Xavier returned to Goa in 1552 with a plan to introduce Christianity into



Missionary to the Orient, Saint Francis Xavier kneels in prayer on his arrival as a missionary at an island in the Malay Archipelago.

New York Public Library

China. To gain entrance to that country, which was then closed to foreigners, he persuaded the Portuguese authorities to send an embassy, of which he would be a member, to the Chinese emperor. The embassy departed from Goa in the spring of 1552; it went no farther than Malacca, but Xavier continued the journey alone, arriving at a small island near Macao in August, 1552. He died there the next December after repeated vain attempts to reach the mainland. His body is enshrined in Goa, in the Church of the Good Jesus.

A man of remarkable energy and organizational ability, Xavier ranks among the greatest missionaries of all times. Canonized in 1622, he was declared patron of the Orient in 1748, patron of the Propagation of the Faith in 1904, and, with the French nun Saint Teresa of Lisieux (q.v.), patron of all missions in 1927. Navigators, too, honor him as their patron. His feast day is Dec. 3.

T.M.H.

XENIA, city in Ohio, and county seat of Greene Co., 3 miles e. of the Little Miami R. and 15 miles s.e. of downtown Dayton. Manufactures

include furniture, machine and metal products, rope and twine, leather goods, synthetic-rubber products, electrical equipment, paint, plastic products, and food products. Printing and publishing are of importance. Xenia is the site of the Greene County Historical Museum, the Charles F. Snediker Museum, and the Ohio Soldiers' and Sailors' Orphans' Home (1869). At Wilberforce, 3 miles to the n.e., is Wilberforce University (men; 1856) and Central State University (1887), originally an outgrowth of Wilberforce University. Central State also maintains an academic center in Xenia. The township was first settled in the late 1700's, and the town laid out in 1803. Incorporated shortly thereafter, Xenia was chartered as a city in 1870. Pop. (1960) 20,445; (1970) 25,373.

XENON, gaseous element with at.no. 54, at.wt. 131.29, b.p. -108.1° C. (-162.58° F.), m.p. -111.9° C.^{611mm} (-169.42° F.^{611mm}), sp.gr. 5.896, and symbol Xe. One of the inert gases (q.v.), xenon is present in the atmosphere (q.v.) in very minute amounts. It was discovered in 1898 by the British chemists Sir William Ramsay (q.v.)

and Morris William Travers (1872–1961). The gas is colorless and odorless. It was formerly believed to be chemically inert, but, since 1962, several compounds of xenon have been discovered. It is used principally in such lighting devices as high-speed photographic tubes.

XENOPHANES (fl. 6th century B.C.), Greek poet, philosopher, and religious reformer, born in Colophon, Asia Minor. He left Colophon in 545 B.C. and was for many years a wandering poet and minstrel in Greece and Sicily. In 536 B.C., according to tradition, he settled permanently in the Phoenician colony of Elea, in southern Italy. There, reputedly, he founded the Eleatic School (q.v.), the philosophical concepts of which were later broadened and systematized by his disciple, the Greek philosopher Parmenides (q.v.). In his writings Xenophanes cleverly satirized the polytheistic beliefs of earlier Greek poets and of his own contemporaries. He ridiculed their deities as gods created in the image of the men who worshiped them. In a famous passage he asserted that if oxen could paint and sculpt, they would depict gods who resembled oxen. Humans, he felt, should reject polytheistic anthropomorphism and recognize instead a single nonhuman deity underlying and unifying all worldly phenomena; see **PANTHEISM**; **THEISM**. In other works he ridiculed the doctrine of transmigration (q.v.) of souls and deplored Greek preoccupation with athleticism and luxurious living at the expense of wisdom. Only fragments of his poems have survived. See **GREEK PHILOSOPHY**; **GREEK RELIGION AND MYTHOLOGY**.

XENOPHON (430?–355? B.C.), Greek historian, soldier, and essayist, born in Athens, the son of an Athenian knight. As a youth he was a disciple of the Greek philosopher Socrates (q.v.). In 401 Xenophon joined an army of Greek mercenaries in the service of Cyrus the Younger (q.v.), Prince of Persia, and took part in a campaign against Cyrus' brother King Artaxerxes II (d. 359 B.C.). After the death of Cyrus in the Battle of Cunaxa, the commanding officers of the Greek mercenaries were treacherously murdered by the Persian satrap Tissaphernes (d. 395 B.C.). Xenophon was among the new officers chosen to command the Greek force, totaling about 10,000 men, thus left leaderless in the heart of the hostile Persian Empire. Assuming responsibility for directing the retreat, he led his men to safety in the ancient Greek colony of Trapezus (now Trabzon, Turkey) on the Black Sea, a 1500-mi. march lasting five months. Their triumphant survival has been attributed largely to his resourcefulness, foresight, and tact. In his most celebrated book, the *Anabasis* (q.v.), he describes

the retreat through an unknown country against disheartening obstacles of terrain and weather, savage enemies, and failure of supplies.

From Trapezus, Xenophon and the "Ten Thousand" moved on to Chrysopolis (now Üsküdar). Shortly after their arrival they entered the service of the Spartans in their campaigns against the Persian satraps of Asia Minor. The ransom Xenophon collected from a wealthy Persian prisoner in this campaign enabled him to live in comfort for the rest of his life. From these foreign adventures he returned to Greece in 394 B.C. as a member of the staff of Agesilaus II (q.v.), King of Sparta. In that capacity he was present at the Battle of Coronea, in which the Spartans defeated the Athenians and their Theban allies. The Athenians retaliated by condemning him as a traitor and sentencing him to banishment. The Spartan government presented him with an estate at Scillus, in Elis, where he lived the life of a country gentleman for twenty-four years. After the military power of Sparta was broken at Leuctra in 371, he was driven from his home. Athens lifted the ban of exile against him, but instead of returning home he apparently spent the rest of his life in Corinth.

Apart from the *Anabasis*, Xenophon's most important writings are *Hellenica*, a continuation, covering the period 411 to 363 B.C., of Thucydides' *History of the Peloponnesian War*; *Cyropaedia*, an idealized biography of Cyrus the Great (q.v.); and *Memorabilia*, recollections of Socrates and Socratic conversations. He also wrote an encomium of Agesilaus; a group of political and economic treatises; a series of essays on horsemanship, hunting, and cavalry warfare; and several additional Socratic dialogues.

As soldier, orator, philosopher, essayist, and historian, Xenophon was the prototype of the talented Athenian. He found the austere Spartan way of life more congenial than the democratic spirit of his native Athens, however. The value of his historical writings is impaired by strong pro-Spartan bias and by the lack of a sense of proportion. His Socratic writings reveal a mind that did not fully comprehend the philosophy of his master, and his own ideas are unoriginal, moralistic, and commonplace. Sincerity and common sense are his strongest characteristics. His style is easy, elegant, and uncomplicated, and he is considered a master of clear exposition. His *Anabasis* is usually one of the first books read by modern students of Greek.

See **GREEK LITERATURE: The Attic Period, 6th–4th Centuries: History**.

XEROGRAPHY, electrostatic dry-printing process for the reproduction of images or docu-

XEROGRAPHY

ments, widely employed in commerce and industry in copying machines; see OFFICE MACHINES: *Duplication of Drawings and Documents: Duplication of Typed Matter*.

The process was invented by the American printer Chester F. Carlson (1906–) in 1937 and first commercially developed in 1950. It employs a photoconductive insulating layer on a metal or other conductive support. The layer is charged electrostatically, either with positive or negative ions (see ION), the polarity of the charge depending on the type of photoconductive insulating layer selected. When the plate is exposed, in a camera or photographic machine, those areas of the coating subjected to light lose a varying portion of the charge, depending upon the intensity of the illumination. Thus the variation of the amount of charge retained on the coated metal plate is established as an electrical or electrostatic pattern of the image. The image is rendered visible by sprinkling over the exposed plate a special, charged powder, which carries an opposite charge to the initial charge applied to the plate and insulating layer. The powder adheres to those areas that have retained their charge. The print is obtained by covering the plate with paper, then applying a charge over the back of the paper of the same polarity as the initial charge applied to the photoconductive insulating layer. In this way the opposite charged powders are transferred to the paper surface. The powder image is then fused onto the paper by exposure to solvent vapors or heat to make the image permanent.

The entire xerographic process can be carried out, in high-speed mechanized equipment, in less than 10 sec., and it is comparatively inexpensive to make these images because the photoconductive insulating layer can be recycled many thousand times. The process has found its primary usefulness in copying of office documents and in low-volume duplication of data.

The xerographic method also permits the making, quickly and cheaply, of paper offset masterplates for low-to-medium-volume runs on office offset-printing presses; see PHOTOMECHANICAL PROCESSES. The method has also been applied to the production of X-ray images in a technique known as xeroradiography; see X RAY. Xerography has applications in industrial non-destructive testing and in mammography, where it is used with the hope of earlier detection of breast cancer in women; see CANCER.

A series of automatic xerographic machines are available today which make office copies on the push of a button, and which are almost fail-proof. Another machine, called Copyflo, devel-

oped in the late 1950's, can be used to reproduce microfilm, and has demonstrated that an entire book can be printed from microfilm in from 3 to 5 min. Copyflo is used primarily to make copies of out-of-print books. See also FACSIMILE.

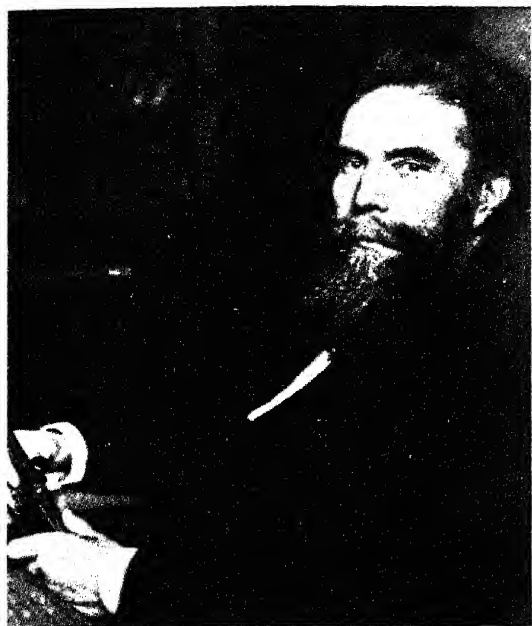
XEROPHYTE. See PLANTS, GEOGRAPHIC DISTRIBUTION OF.

XERXES I (Persian *Khshayarsha*) (about 519–465 B.C.), King of Persia (486–465 B.C.). He was the son of the Persian king Darius the Great (see *under* DARIUS) and of Atossa (fl. 6th century B.C.), daughter of the Persian king Cyrus the Great (q.v.). Ascending the throne upon the death of his father, he subdued a rebellion in Egypt, and then spent three years in preparing a great fleet and army to punish the Greeks for their aid to the Ionian cities in 498 B.C. and for their victory over the Persians at Marathon (q.v.) in 490 B.C. The Greek historian Herodotus (q.v.) gives as the combined strength of Xerxes' land and naval forces the incredible total of 2,641,610 men. Xerxes is said to have crossed the Hellespont by a bridge of boats a mile in length (see DARDANELLES), and to have cut a canal through the isthmus of Mount Athos. During the spring of 480 B.C. he marched with his forces through Thrace, Thessaly, and Locris. At Thermopylae (q.v.) 300 Spartans, under their king Leonidas I (q.v.), made a courageous but futile stand, delaying the Persians for ten days. Xerxes then advanced into Attica and burned Athens, which had been abandoned by the Greeks. At the battle of Salamis (q.v.) later in 480 B.C., his fleet was defeated by a much smaller contingent of Greek warships commanded by the Athenian Themistocles (q.v.). Xerxes thereupon retired to Asia Minor, leaving his army in Greece under the command of his brother-in-law Mardonius (d. 479 B.C.), who was slain at Plataea (q.v.) in the following year. Xerxes was murdered by Artabanus (d. 464 B.C.), captain of the palace guard; he was succeeded by his son Artaxerxes I (d. 424 B.C.). See PERSIA: *The First Empire*.

XINGU, river of Brazil, formed by the union of three streams in the N. section of the plateau of Mato Grosso. About 1230 mi. long, it flows northward through the States of Mato Grosso and Pará and empties into the delta of the Amazon R. The central section of the river contains numerous impassable falls and rapids. The river is navigable for about 100 mi. above its mouth. **XOCHIMILCO, FLOATING GARDENS OF.** See MEXICO CITY.

X RAY, penetrating electromagnetic radiation, having a shorter wavelength than light, and produced by bombarding a target, usually made of

tungsten (q.v.), with high-speed electrons; see ELECTROMAGNETIC RADIATIONS; ELECTRON; LIGHT; RADIATION. X rays were discovered accidentally in 1895 by the German physicist Wilhelm Conrad Roentgen (q.v.) while studying cathode rays (q.v.) in a high-voltage, gaseous-discharge tube. Despite the fact that the tube was encased in a



Wilhelm Conrad Roentgen

General Electric Co.

black cardboard box, Roentgen noticed that a barium-platinocyanide screen, inadvertently lying nearby, emitted fluorescent light whenever the tube was in operation. After conducting further experiments, he determined that the fluorescence was caused by invisible radiation of a more penetrating nature than ultraviolet rays; see FLUORESCENCE AND PHOSPHORESCENCE; ULTRAVIOLET RADIATION. He named the invisible radiation "X ray", because of its unknown nature. Subsequently, X rays were known also as Roentgen rays in his honor.

NATURE OF X RAYS

X rays are electromagnetic waves ranging in wavelength from about 100 angstroms (\AA) to 0.0001\AA (1 angstrom is equivalent to about 4 billionths of an inch); see WAVE MOTION. The shorter the wavelength of the X ray, the greater is its penetrating power. Longer wavelengths, near the ultraviolet-ray band of the electromagnetic spectrum, are known as soft rays; see SPECTRUM. The shorter wavelengths, closer to and overlapping the gamma-ray range, are called hard X rays; see RADIOACTIVITY. A mixture of many different wavelengths is known as "white" X

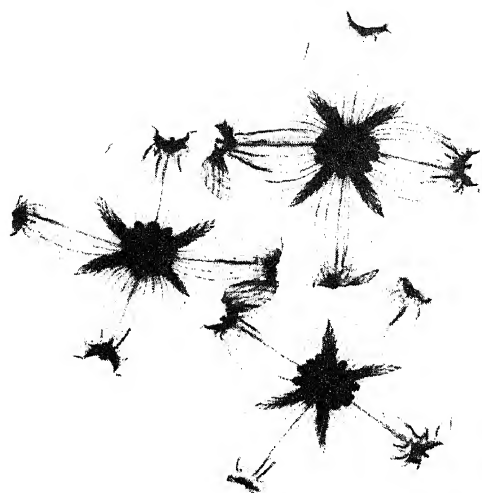
rays, as opposed to "monochromatic" X rays, which represent only a single wavelength. Both light and X rays are produced by transitions of electrons, light by the transitions of outer electrons, and X rays by the transitions of inner electrons. In the case of bremsstrahlung radiation (see below), X rays are produced by the retardation or deflection of a bombarding electron passing through a strong electrical field. Gamma rays, which are identical to X rays in their effect, are produced by transitions within the nucleus itself; see ATOM AND ATOMIC THEORY.

X rays are produced whenever high-velocity electrons strike a material object. Much of the energy of the electrons is lost in heat (q.v.); the remainder produces X rays by causing changes in the target's atoms as a result of the impact. The X rays emitted can have no more energy than the kinetic energy of the electrons which produce them; see ENERGY. Moreover, the emitted radiation is not monochromatic but is composed of a wide range of wavelengths with a sharp, lower wavelength limit corresponding to the maximum energy of the bombarding electrons. This continuous spectrum is referred to by the German name bremsstrahlung, which means braking (or slowing down) radiation, and is independent of the nature of the target. If the emitted X rays are passed through an X-ray spectrometer, certain distinct lines are found super-

Radiograph made by Wilhelm Roentgen in 1896.

General Electric Co.





A radiograph of dogwood blossoms illustrates the use of X rays for nondestructive testing of opaque objects. Oak Ridge National Laboratory, operated by Union Carbide Corp. for the U.S. Atomic Energy Commission

imposed on the continuous spectrum; these lines, known as the characteristic X rays, represent wavelengths which depend only on the structure of the target atoms. In other words, a fast-moving electron striking the target can do two things: it can excite X rays of any energy up to its own energy; or it can excite X rays of particular energies, dependent on the nature of the target atom.

X-RAY PRODUCTION

The first X-ray tube was the Crookes tube, a partially evacuated glass bulb containing two electrodes, named after its designer, the British chemist and physicist Sir William Crookes (q.v.). When an electric current passes through such a tube, the residual gas is ionized, and positive ions, striking the cathode, eject electrons from it. These electrons, in the form of a beam of cathode rays, bombard the glass walls of the tube and produce X rays. Such tubes produce only soft X rays of low intensity. See ION; IONIZATION.

An early improvement in the X-ray tube was the introduction of a curved cathode to focus the beam of electrons on a heavy-metal target, called the anticathode, or anode. This type generates harder rays of shorter wavelengths and of greater intensity than those produced by the original Crookes tube, but the operation of such tubes is erratic, as the X-ray production depends on the gas pressure within the tube.

The next great improvement was made in 1913 by the American physicist William David Coolidge (1873–1975). The Coolidge tube is

highly evacuated and contains a heated filament and a target. It is essentially a thermionic vacuum tube (see VACUUM TUBES, THERMIONIC), in which the cathode emits electrons because it is heated by an auxiliary current and not because it is struck by ions as in the earlier types of tubes. The electrons emitted from the heated cathode are accelerated by the application of a high voltage across the tube. As the voltage is increased, the minimum wavelength of the radiation decreases.

Most of the X-ray tubes in present-day use are modified Coolidge tubes. The larger and more powerful tubes have water-cooled anticathodes to prevent melting under the impact of the electron bombardment. The widely used shock-proof tube is a modification of the Coolidge tube with improved insulation of the envelope (by oil) and grounded power cables. Such devices as the betatron (q.v.) are used to produce extremely hard X rays, of shorter wavelength than the gamma rays emitted by naturally radioactive elements.

TYPICAL X RAYS AND GAMMA RAYS

Rays	Volts	Wavelength ¹	Absorbed by ²
Ultrasoft X rays	124	100 Å	—
Soft X rays	1240	10 Å	0.12 in. air
Soft X rays	12,400	1 Å	83 in. air
Hard X rays	124,000	0.1 Å	0.07 in. water
Gamma rays	1,000,000	0.0124 Å	1.7 in. water
X rays produced by betatron	100,000,000	0.000124 Å	0.006 in. lead
			0.34 in. lead
			Many feet of lead

¹ One angstrom unit (Å) equals about four billionths of 1 in.

² These amounts of absorbing material decrease the intensity of radiation by exactly one half. A double-thickness screen reduces the remaining intensity by one half, resulting in an overall decrease in the original intensity by three quarters.

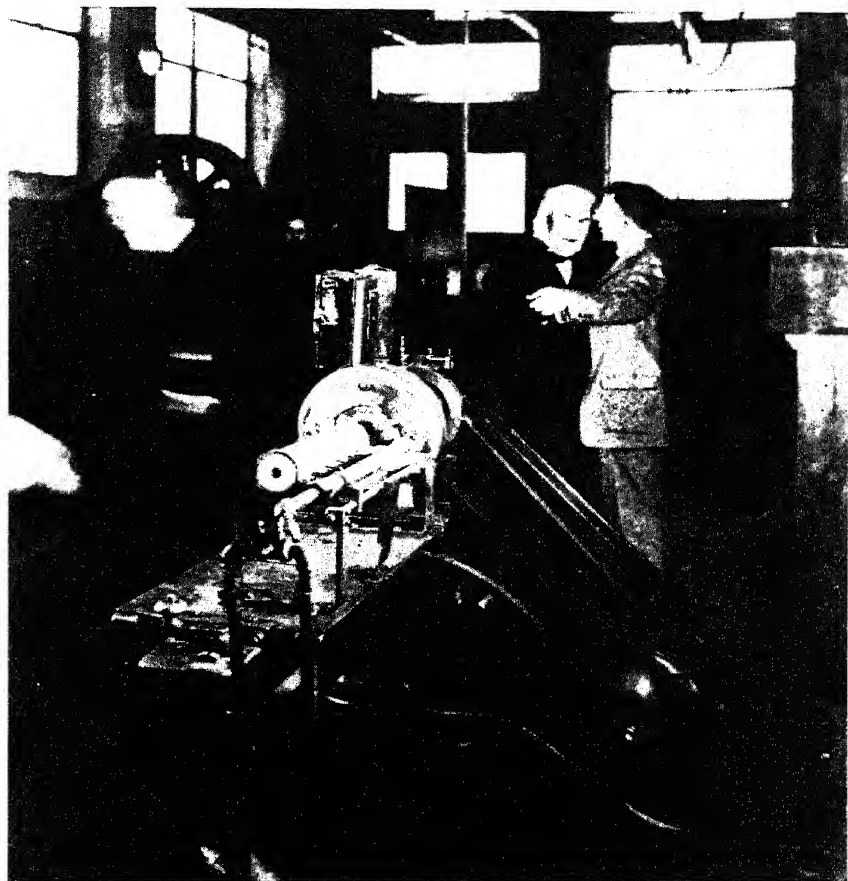
PROPERTIES OF X RAYS

X rays affect a photographic emulsion in the same way light does; see PHOTOGRAPHY. Absorption of X radiation by any substance depends upon its density and atomic weight. The lower the atomic weight of the material, the more transparent it is to X rays of given wavelengths. When the human body is X-rayed, the bones, which are composed of elements of higher atomic weight than the surrounding flesh, absorb the radiation more effectively and therefore cast darker shadows on the photographic plate. Another type of radiation, neutron radiation, now used in some types of radiography, produces almost opposite results. Objects that cast dark shadows in an X-ray picture are almost always light in a neutron radiograph.

Fluorescence. X rays also cause fluorescence in certain materials, such as barium platinocya-

William David Coolidge, American physical chemist (right), demonstrates to Thomas A. Edison his development of ductile tungsten for the first hot-cathode X ray.

General Electric Co.



nide and zinc sulphide. If a screen coated with such fluorescent material is substituted for the photographic films, the structure of opaque objects may be observed directly. This technique is known as fluoroscopy; see FLUOROSCOPE.

Ionization. Another important characteristic of X rays is their ionizing power, which depends upon their wavelength. The capacity of monochromatic X rays to ionize is directly proportional to intensity. This property provides a method for measuring X-ray intensity. When X rays are passed through an ionization chamber (q.v.), an electric current is produced which is proportional to the intensity of the incident beam. In addition to ionization chambers, there are more sensitive devices, such as the Geiger-Müller counter and the scintillation counter (q.v.), for measuring X-ray intensity on the basis of ionization. In addition, the path of X rays, by virtue of their capacity to ionize, can be made visible in a cloud chamber (q.v.).

X-Ray Diffraction. X rays may be diffracted by passage through a crystal (q.v.), or by reflection (scattering) from a crystal, which consists of regular lattices of atoms that serve as fine diffrac-

tion gratings; see DIFFRACTION; DIFFRACTION GRATING. The resulting interference patterns may be photographed and analyzed to determine the wavelength of the incident X rays, or the spacings between the crystal atoms, whichever is the unknown factor; see INTERFERENCE. X rays may also be diffracted by ruled gratings if the spacings compare to the wavelengths of the incident X rays.

INTERACTION WITH MATTER

In the interaction between matter and X rays, three mechanisms exist by which X rays are absorbed; all three mechanisms demonstrate the quantum nature of X radiation; see QUANTUM MECHANICS; QUANTUM THEORY.

Photoelectric Effect. When a quantum of X radiation, or photon (q.v.), strikes an atom, it may impinge on an electron within an inner shell and eject it from the atom. If the photon carries more energy than is necessary to eject the electron, it will transfer its residual energy to the ejected electron in the form of kinetic energy. This phenomenon, called the photoelectric effect, occurs chiefly in the absorption of low-energy X rays. See PHOTOELECTRIC CELL.

X RAY

Compton Effect. The Compton effect, discovered in 1923 by the American physicist and educator Arthur Holly Compton (q.v.), is an important manifestation of the absorption of X rays of shorter wavelengths. When a high-energy photon collides with an electron, both particles may be deflected at an angle to the direction of the path of the incident X ray. The incident photon, having delivered some of its energy to the electron, does not vanish as in the photoelectric effect, but emerges from the collision with a longer wavelength. These deflections, accompanied by a change of wavelength, are known as Compton scattering.

Pair Production. In the third type of absorption, especially evident when elements of high atomic weight are irradiated with extremely high-energy X rays, the phenomenon of pair production occurs. When a high-energy photon penetrates the electron shell close to the nucleus, it may create a pair of electrons, one of negative charge and the other positive; a positively charged electron is also known as a positron (q.v.). This pair production is an example of the conversion of energy into mass (qq.v.). The photon requires at least 1.2 mev of energy to yield the mass of the pair. If the incident photon possesses more energy than is required for pair production, the excess energy is imparted to the electron pair as kinetic energy. The paths of the two particles are divergent from the point of their origin.

APPLICATIONS OF X RAYS

The principal uses of X radiation are in the field of scientific research, industry, and medicine.

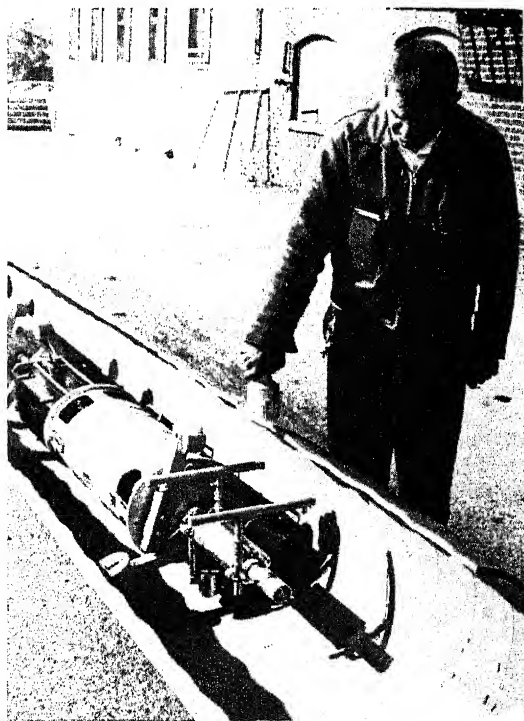
Research. The study of X rays played a vital role in theoretical physics, especially in the development of quantum mechanics. As a research tool, X rays enabled physicists to confirm experimentally the theories of crystallography; see CRYSTAL: *Crystallography*. By using X-ray diffraction methods, crystalline substances may be identified and their structure determined. Virtually all of present-day knowledge in this field was either discovered or verified by X-ray analysis. X-ray diffraction methods can be applied also to powdered substances which are not crystalline, but display some regularity of molecular structure. By means of such methods chemical compounds can be identified and the size of ultramicroscopic particles can be established. Chemical elements and their isotopes may be identified by X-ray spectroscopy, which determines the wavelengths of their characteristic line spectra. Several elements, such as hafnium and francium (qq.v.), were discovered by analysis of X-ray spectra.

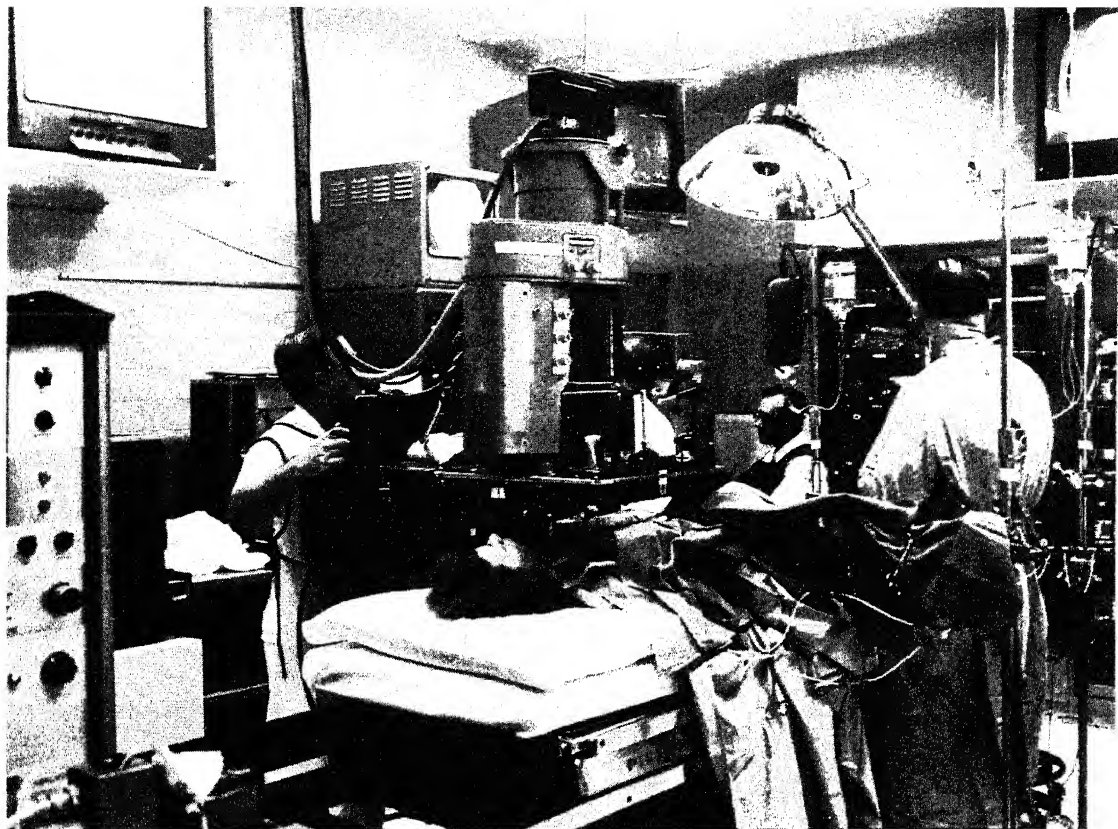
A number of recent applications of X rays in research are assuming increasing importance. Microradiography, for instance, produces fine-grain images which can be enlarged considerably. Two radiographs can be combined in a projector to produce a three-dimensional image called a stereoradiogram. Color-radiography is also used to enhance the detail of X-ray photographs; in this process, differences in the absorption of X rays by a specimen are shown as different colors; see COLOR. Extremely detailed and analytical information is provided by the electron microprobe, which uses a sharply defined beam of electrons to generate X rays in an area of specimen as small as 1 micron (about 1/25,000 in.) square.

Industry. In addition to the research applications of X rays in physics, chemistry, mineralogy, metallurgy, and biology, X rays are used in industry as a research tool and for many testing processes. They are valuable in industry as a means of testing objects such as metallic castings without destroying them. X-ray images on photographic plates reveal the presence of flaws, but a disadvantage of such inspection is that the necessary high-powered X-ray equipment is bulky and expensive. In some instances, therefore, radioisotopes which emit highly pen-

Cutout section of pipe shows a self-propelled X-ray machine used to inspect welded joints in pipelines.

Picker Corp.





etrating gamma rays are used instead of X-ray equipment. These isotope (q.v.) sources can be housed in relatively light, compact, and shielded containers. Cobalt 60 and cesium 137 have been used widely for industrial radiography. Thulium 70 has been used in small, convenient, isotope projectors for some medical and industrial applications.

Many industrial products are inspected routinely by means of X rays, so that defective products may be eliminated at the point of production. Other specialized applications include the detection of fake gems and the detection of smuggled goods in customs examinations. Ultra-soft X rays are used to determine the authenticity of works of art, and for art restoration.

Medicine. X rays are used extensively in medicine as a diagnostic tool, which involves the use of X-ray photographs, called radiographs, and of fluoroscopy, and in radiotherapy, to treat certain diseases, notably cancer, by direct X-ray exposure; see *CANCER: Treatment: Radiation Therapy*.

The use of radiographs for diagnostic purposes was inherent in the penetrating properties of X rays. Within a few years of their discovery, X rays were being used to locate foreign bodies, such as bullets, within the human body. With the development of improved X-ray techniques, minute differences in tissues were revealed by

This cardiac catheterization room is fully equipped with an X-ray fluoroscopic unit, an orthicon television camera, a high-speed 35-mm cinecamera, and a videotape recorder above the patient, video-display units at the top of the picture, and a special horizontal cardiac-X-ray table for observation of the patient. Picker Corp.

radiographs, and many pathological conditions could be diagnosed by means of X rays. X rays provide the most important single method of diagnosing tuberculosis (q.v.). Pictures of the lungs are easy to interpret because the air spaces are more transparent to X rays than the lung tissues. Various other cavities in the body may be filled artificially with contrasting media, either more transparent or more opaque to X rays than the surrounding tissue, so that a particular organ may be brought more sharply into view. Barium sulphate, which is highly opaque to X rays, is used for the X-ray examination of the gastrointestinal tract. Certain opaque compounds are administered either by mouth or by injection into the bloodstream for kidney or gall-bladder examination.

A recent X-ray device, used without the aid of dyes, offers clear views of any part of the anatomy, including soft organ tissues. Called the body scanner or CAT scanner (for "computerized axial tomography"), it rotates 180 degrees around a patient's body, sending out a pencil-thin X-ray beam at 160 different points. Crystals

positioned at the opposite points of the beam pick up and record the absorption rates of the varying thicknesses of tissue and bone. This data is then relayed to a computer that turns the information into a picture on a screen. Using the same dosage of radiation as that of the conventional X-ray machine, an entire "slice" of the body is made visible with about one hundred times more clarity. The scanner was invented in 1972 by the British electronics engineer Godfrey N. Hounsfield (1919–). It was expected to be in general use by 1979.

For applications of radioisotopes that emit gamma rays, see TRACERS.

X-Ray Astronomy. Powerful sources of X-ray emission from bodies in outer space, including one in Crab nebula and another in the constellation Scorpius, were detected in the late 1960's. Low-level emission of X rays from the sun (q.v.) has been detected for some time, and the recent development of space and rocket (q.v.) technology has led to the use of X-ray detecting equipment aboard manned and unmanned spacecraft to study these radiations without distortion from the earth's atmosphere. See ASTRONAUTICS: *Space Programs—Unmanned*; ASTRONOMY; SATELLITE, ARTIFICIAL. Like radio, infrared, and ultraviolet techniques, X-ray astronomy has enabled scientists to obtain data not made available by visible-light observations; see INFRARED RADIATION; RADIO ASTRONOMY; ULTRAVIOLET RADIATION. X-ray techniques can also see farther out into space than optical telescopes, and see through opaque interstellar dust clouds. The newly discovered astronomical objects, emitting concentrated amounts of X radiation, are known as X-ray stars, and include Sco X-1 in the constellation Scorpius, and Cygnus XR-2, which is thought to be a double star.

BIOLOGICAL EFFECTS OF X RADIATION

When X rays strike living tissue, the radiation produces biological effects through absorption. Photons which interact with the tissue are destructive to living cells by changing their chemical composition through ionization. If used indiscriminately, X rays produce burn-like lesions which heal very slowly. Each type of cell has its own degree of tolerance to X rays, and the dosage that will kill one type of cell may only injure another, the tolerance depending on the stage in the growth and development cycle of the cell. X rays have a greater destructive effect on certain rapidly growing abnormal tissues, such as tumors, than on healthy cells. When intense X rays can be applied directly to a tumor, as in the case of skin tumors, X-ray therapy is very effective, but internal tumors are harder to treat.

Radiation Sickness. The symptoms of overexposure, called radiation sickness (q.v.), include a decrease in the number of white blood cells, loss of hair, sterility, and mutation (q.v.). These effects may not become manifest for several years, depending on the dosage and the energy level of the radiation. Sterility produced by moderate doses may be only temporary. Mutations may not be revealed until the second or third generation; see HEREDITY: *Mutation*. Utmost care in the use of X rays must be exercised to avoid overexposure. Inasmuch as many of the biological effects of high-energy radiation are cumulative, exposure should be kept to a minimum; see also RADIOACTIVE FALLOUT.

The international dosage used in X-ray therapy is based on the so-called roentgen unit, *r*, which is also used to measure gamma radiation. It determines the intensity of radiation by utilizing the property of X rays to ionize air particles. For measuring the dose absorbed by living tissue, which varies with the wavelength of radiation emitted, the rad unit is employed, based on the amount of energy imparted to the tissue exposed to radiation.

Recent improvements in X-ray equipment permit medical examinations to be made with minimum exposure. An outstanding development, announced in the late 1950's, was the perfection of a group of electronic devices called light amplifiers, which reduce drastically the intensity of the radiation required for diagnostic purposes. One of these devices, known as the Lumicon, amplifies light as much as 40,000 times. Linked with an X-ray machine, the device has enabled physicians to examine their patients with X rays of very low intensity.

E.C.W. & J.T.S.

XYLEM, woody tissue, found in higher plants, that conducts water and inorganic salts throughout the plant and provides it with mechanical support. In leaves, flowers, and young stems, xylem is present in conjunction with phloem (q.v.) in the form of conducting strands called vascular bundles. In roots there is a central core of xylem; see ROOT. Xylem that derives from the shoot and root-growing points is called primary xylem. In addition, new xylem, called secondary xylem, may be added by the activity of the cambium, which actively divides cells situated between the xylem and phloem. This division gives rise to new xylem cells toward the center in roots, and toward the outside in most stems. Some plants have little or no secondary xylem, in contrast to woody plants in which indefinite amounts of secondary xylem are added to stems and roots. Thus, secondary xylem is the botani-

cal term equivalent to the word "wood". See STEM.

Xylem may contain three types of conducting cells: tracheids, vessel elements, and fibers. At maturity, when functioning in conduction, all of these cells are dead. Tracheids are elongated cells with thick walls characterized by small, sharply defined thin areas known as pits. Vessel elements are specialized tracheids in which the end walls have one or more pores; a vertical series of vessel elements forming a continuous tube is known as a vessel. Fibers, which are specialized tracheids with much-thickened walls, function only slightly in conduction, but serve to increase the strength of xylem.

The xylem of primitive plants, such as ferns and conifers, consists of tracheids. In most flowering plants, the xylem also contains well-developed vessels and fibers. Because sequences in the specialization of all these tissue elements can be observed quite clearly, the study of xylem provides important clues in the evolutionary development of higher plants. See PLANT MORPHOLOGY.

S.C.

XYLOPHONE (fr. Gr. *xylon*, "wood"; *phone*, "sound"), musical instrument of the percussion family, closely related to the marimba and glockenspiel (qq.v.) and the cimbalon. It consists of a series of bars graduated in length to produce the tones of the scale, and mounted on belts of straw, rubber, or felt. Modern xylophones have from 30 to 55 bars arranged in two keyboards; most instruments have tubular resonators suspended from each bar. The xylophone is played by striking the bars with hard wooden mallets. It has a range of two to four octaves and produces a brilliant and penetrating tone. There are various types of xylophones, differing from each other in the type of mounting, the number of bars, and the material from which the bars are made (glass, various metals, as well as wood).

Simple forms of the xylophone were played in Africa and Asia in ancient times, and the instrument still figures prominently in Asian and African folk music. In the 16th century it was exported from the Orient to eastern Europe. By the 19th century Polish and Russian performers had popularized it in western Europe. The French composer Camille Saint-Saëns (q.v.) was the first to include it in a written composition. In his *Danse Macabre*, the xylophone strikingly suggests the rattling bones of dancing skeletons. Among other compositions in which it is used are *The Golden Age* (1930) by the Soviet composer Dimitri Shostakovich and *Petrouchka* (1911) by the Russian-American composer Igor Stravinsky (qq.v.).

XYZ AFFAIR, in United States history, an incident involving an American commission sent to France in 1797 for the purpose of negotiating outstanding differences between the two countries. These differences arose largely out of the refusal by the U.S. to come to the aid of France, then at war with Great Britain, as stipulated in the Franco-American treaty of 1778. Further, under the terms of Jay's Treaty (q.v.), which the U.S. and Great Britain concluded in 1794, the U.S. had accepted the British view of the rights and obligations of neutrals and subsequently had ordered French ships out of American ports. The French retaliated by preying upon American shipping. In an attempt to reach a settlement, President John Adams appointed a commission consisting of the American statesmen John Marshall (qq.v.), Charles Cotesworth Pinckney (see under PINCKNEY), and Elbridge Thomas Gerry (see under GERRY) to negotiate with the French Directory (q.v.). The commission arrived in Paris in October, 1797.

The French foreign minister Charles Maurice de Talleyrand-Périgord (q.v.) informed the commission through three secret agents that the Directory would not negotiate with the mission unless the U.S. agreed to "lend" the French government the equivalent of \$10,000,000 and to present him, Talleyrand, with a "gift" of \$250,000. The commissioners rejected the proposals and forwarded the substance of the French demands to President Adams, who submitted them to the Congress. During the negotiations with the French agents Pinckney is said to have uttered the now famous slogan "millions for defense, but not one cent for tribute".

In April, 1798, the dispatches of the American commissioners were made public; in the otherwise complete copies, the letters X, Y, and Z were substituted for the names of Talleyrand's emissaries. The exposure of French diplomatic tactics engendered widespread indignation, and the Congress authorized preparations for war. Although U.S. and French naval vessels clashed on a number of occasions, there was no formal declaration of war. The French government adopted a conciliatory attitude and later in 1798 officially repudiated the so-called X, Y, and Z agents, denouncing them as charlatans. President Adams, who also wished to avoid war, sent a new commission to France late in 1799. Napoléon Bonaparte, later the French emperor Napoleon I (q.v.), came to power before the commissioners reached Paris. In September, 1800, they finally arranged with him a convention that once more put the two nations on friendly terms.

Y, twenty-fifth letter in the English alphabet. It is derived from the Latin alphabet, into which it was taken during the reign of the Roman emperor Augustus (q.v.) to transliterate the Greek letter *upsilon* (Υ). The Greek letter was in turn borrowed from the Phoenician letter *vau*, which was also the basis of the modern English letters U, V, and W; for an account of its derivation and a representation of its form, see separate articles on those letters.

The phonetic values of the letter y in modern English include both vowel and consonant sounds. As a vowel, its usage dates mainly from the Middle English period, when scribes fell into the habit of substituting y for i (particularly a final i) because of the calligraphically pleasing flourish in the cursive form of the letter; examples of this usage occur in the modern spellings of such words as *city*, *lady*, and *my*. A vowel y sound also occurs as a substitute for the vowel *upsilon* in certain words of Greek origin, such as *myth* and *syntax*. As a consonant, the y sound is technically known as a voiced palatal spirant, and occurs most frequently as the initial sound in words of Germanic origin, such as *yield* and *yard*. In certain archaic uses of the letter, represented in the word *ye*, the character is substituted for a phonetically unrelated Anglo-Saxon rune known as *thorn* and represented by the sign þ. The y character became formally but not phonetically confused with the rune during the Middle English period; in the phrase "ye olden time", for example, the first word is properly pronounced *the*.

The capital Y is used in chemistry as a symbol for the element yttrium, and in physics for electrical admittance and for Young's modulus of elasticity (see *ELASTICITY*). In medieval Roman numerals Y stands for 150 and, in the form Ÿ, for 150,000. The lowercase y is used in all branches of mathematics, but especially algebra, as a symbol for an unknown quantity or variable, and in

analytic geometry for the ordinate of the rectangular coordinate. The capital or lowercase forms of the letter may be used to stand for the twenty-fifth or, when J, V, and W are omitted, the twenty-second member of a series, class, group, or order. The capital letter is frequently used in compound words to signify anything having the shape of the letter, as in Y-gun and Y level.

M.P.

YABLONOVYY RANGE, sometimes YABLONOI, mountain range of the Soviet Union, in s.e. Siberia, E. of Lake Baykal. Extending 1000 mi. in a n.e.-s.w. direction, it forms the watershed between the waters flowing N. through the Lena R. into the Arctic Ocean and s.e. through the Amur R. into the Pacific Ocean. The highest peak in the range is Bolshoi Saranakan (5280 ft.).

YACHTING, operation of noncommercial boats for pleasure, especially for cruising, racing, or fishing. The pastime involves the use of yachts, which may be defined as habitable sailing or motor-powered vessels, and of other craft which properly cannot be called yachts. Among such craft are small sailboats and undecked boats propelled by inboard or outboard motors; see *MOTORBOAT*.

Boats utilizing sails for propulsive power may be classified as sailing cruisers, day sailers, auxiliary cruisers, and motor sailers. As the names suggest, both the sailing cruiser and the day sailer are driven solely by sails; see *SAIL*. The sailing cruiser is longer and beamier than the day sailer as a rule and, unlike the latter, possesses living facilities. An auxiliary cruiser is a sailing cruiser equipped with an inboard engine. A motor sailer is an under-rigged, heavily powered auxiliary cruiser, that is, a vessel dependent primarily on its engine or engines, but capable of maintaining headway under sail. See *SAILING*.

Sailing craft used for racing may be grouped into three main categories, namely one-design, rating, and handicap. One-design boats come in



numerous classes, and all boats belonging to a particular class are identical. In one-design racing, consequently, success is determined by seamanship rather than by differences in design or equipment. The boats of a rating class differ slightly from each other in certain particulars, such as length of hull, displacement, and sail area. All boats of a given class conform, however, to a certain overall rating arrived at in accordance with a set mathematical formula. The success of a rating-class sailboat consequently depends to some extent on the expertise of its

A 72-ft. ketch competes in the 844-mi. yachting race from Miami, Fla., to Montego Bay, Jamaica. UPI

designer. Boats differing widely in size and design compete in handicap racing. The boats are measured according to certain rating criteria and assigned appropriate time allowances. The handicap system enables small and shallow-draft boats to race on equal terms with larger and deeper craft.

Sailboat competitions are governed by strict, internationally recognized racing rules, the most

YACHTING

important of which are aimed at the avoidance of collisions between competing boats. The main forms of sailboat competition are closed-course, coastwise, and ocean. Closed-course races are generally contested on lakes or inshore waters over a three-leg, triangular course from 3 to 30 mi. long. Coastwise races usually are sailed over much longer courses on lakes, inland waters, or offshore. In ocean racing the competing vessels must be navigated over extensive stretches of open sea. Notable ocean races include the California-Hawaii and Newport-Bermuda contests.

Yacht races are held by local, regional, or national organizations, but are all governed by the rules of the International Yacht Racing Union. The most spectacular and hazardous races are two in which the yachts are sailed by one-man crews. The single-handed transatlantic race was inaugurated in 1960 and is sailed every four years. The winner of the first race was Sir Francis Chichester (1901-72), who later sailed his tiny ketch, *Gypsy Moth*, around the world in 1966-67. Even more ambitious than the transat-

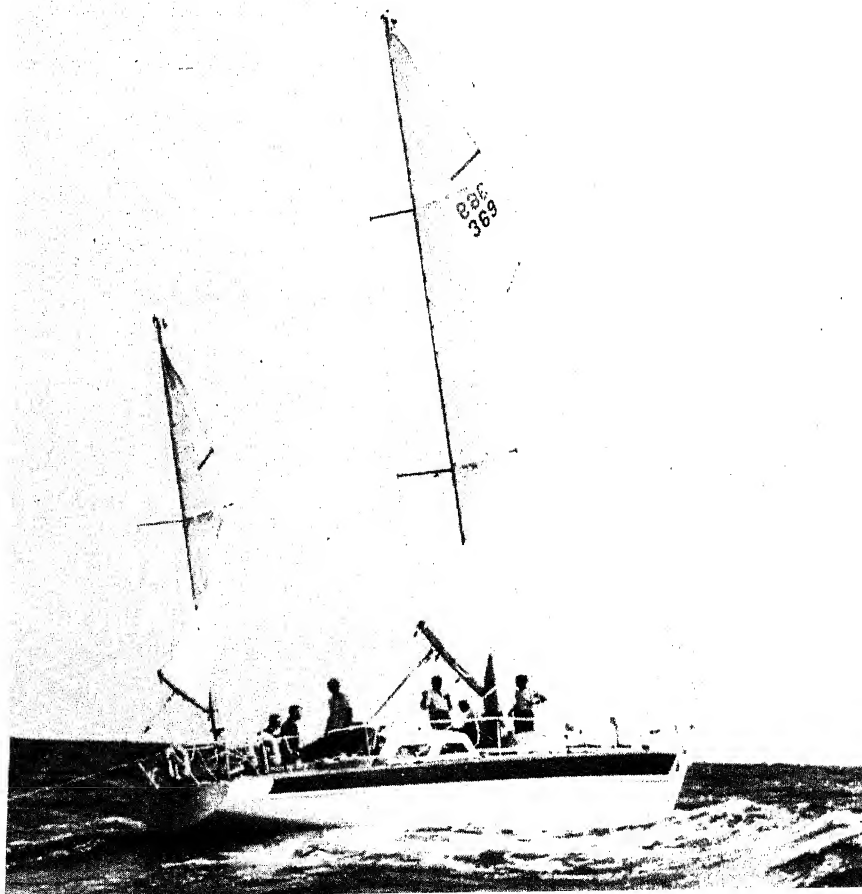
lantic race is the London *Sunday Times* single-handed race around the world. The race was first held in 1968 and was won by Robin Knox-Johnston (1928-). The only man to finish, he returned to his starting point, Falmouth, England, after ten months and three days of sailing around the globe.

The first yacht races held as part of the Olympic Games were contested in 1908. The races have been part of the Olympic program since then, but the yacht classes have changed from time to time. In the 1976 summer Olympics, there were events for six yacht classes: Tornado, Flying Dutchman, 470, Soling, Finn, and Tempest.

The cabin cruiser, which is equipped with complete living quarters for two or more persons, is the most popular type of habitable motor-powered craft used in yachting. The larger craft are powered by from one to three inboard gasoline or diesel engines. Many of the smaller types, including craft that can be assembled from kits, are driven by one or two outboard motors.

A 40-ft. yawl crosses the finish line in the annual yachting classic from Newport, R.I., to Bermuda.

Bermuda News Bureau



A 12-meter sloop of the class that competes for the America's Cup.

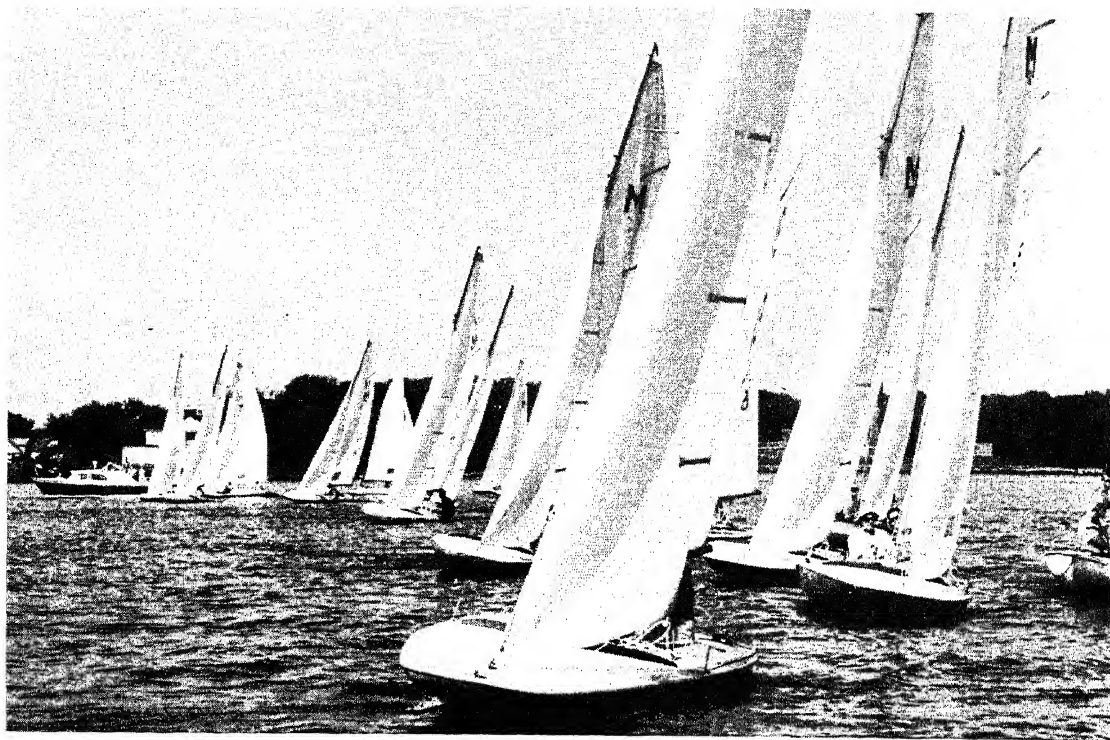
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History. The first yachtsmen probably were fishermen of the prehistoric period who enjoyed leisure-time cruising or racing in their rude sailing craft. Sumptuously decorated pleasure boats were maintained by the privileged classes of ancient Egypt, China, Greece, and Rome; however, such craft were usually naval or commercial vessels fitted with luxurious appointments. The first boats designed solely for pleasure and sport were commissioned by Dutch noblemen and merchants early in the 17th century. The Dutch pleasure craft were swift, maneuverable sailing vessels from 45 to 65 ft. in length. Later in the 17th century the English king Charles II (q.v.) popularized the sport in England after receiving a yacht as a gift from the Dutch people. In 1720 the first known formal organization of yachtsmen, the Cork Harbour Water Club, was founded in Ireland. The oldest

yachting organization still existing is the Royal Yacht Squadron, founded in 1815 as the Royal Yacht Club of England.

Work boats were sailed extensively for pleasure in America during colonial times, particularly in New England and New York. The first large United States vessel built specifically as a yacht was the schooner *Cleopatra's Barge*, constructed in 1816 in Salem, Mass. The New York Yacht Club, the parent organization of American yachting and yacht racing, was founded in 1844. In 1850-51 six members of the New York Yacht Club financed the construction of the first great U.S. racing yacht, the 100-ft. schooner *America*. The *America* subsequently won a brilliant victory at an international regatta off the Isle of Wight, England, in August, 1851. The America's Cup (q.v.), a trophy named for the *America*, became the most famous prize in yacht racing af-



Class M scows cross the starting line in a race on Lake Winnebago, near Oshkosh, Wis.

UPI

ter it was given to the New York Yacht Club in 1857 to be held for perpetual international challenge competition.

Yachting was revolutionized by the appearance late in the 19th century of various types of power-driven craft, particularly steam yachts. The development of power boating was tremendously accelerated by the successful demonstration (1887) of a craft propelled by a two-cylinder internal-combustion engine.

Sailboat racing was gradually transformed, beginning about 1890, by the development of one-design craft. The one-design boats, usually from 15 to 40 ft. in length, and relatively inexpensive to build and maintain, eventually attracted thousands of middle-income sailing enthusiasts.

The last years of the 19th century and the early decades of the 20th century were the heyday of huge steam yachts. Many rivaled commercial liners in luxury. At the same time yacht builders produced growing numbers of moderately priced power boats equipped with internal-combustion engines. Despite the increasing popularity of power craft, sail dominated the sport until the end of World War II. Competition for the America's Cup continued, and racing fleets of smaller one-design craft, such as Internationals, Atlantics, Lightnings, Stars, Com-

ets, and Snipes, increased steadily in size. The period was marked also by significant changes in power yachting. For reasons of economy, the enormous steam yachts of the early 1900's gradually were supplanted by smaller, less costly, cabin cruisers powered by gasoline or diesel engines.

In the years following World War II, sail and power yachting achieved unprecedented heights of popularity, particularly in the U.S. and Canada. Factors contributing to the phenomenal upsurge were a general rise in personal income and the mass production of many types of serviceable, low-cost boats. The use of fiberglass and aluminum for hulls and nylon for sails has reduced maintenance costs. Many small-boat owners transport their craft by automobile trailer from one body of water to another.

In the last half of the 1970's, nearly 50,000,000 people in the U.S. participated in recreational boating. Thousands of marinas have been established to moor their boats and service their needs. Among the largest centers of yachting activity are the waters off Newport, R.I.; Long Island Sound between New York and Connecticut; Chesapeake Bay; the Great Lakes; and Puget Sound in the state of Washington.

YAHWEH. See JEHOVAH.

YAK, wild or domesticated Tibetan ox, *Bos grunniens*, belonging to the family Bovidae

Yak, *Bos grunniens*
Arthur W. Ambler -
National Audubon Society



(q.v.). It is native to the high plateaus and mountains of central Asia, where the climate is cold and dry. The wild yak is a massive animal, blanketed with a thick coat of long, greyish-brown hair. The bulls, which are larger than the females, are about 6 ft. high at the shoulders and weigh more than 1000 lb. The back of the yak is humped over the shoulders. The horns are long and wide-spreading, and the tail is long-haired and bushy.

The domestic yak is of various colors, chiefly black and white, and of smaller size than the wild animal, as a result of cross-breeding with cattle. Yaks are valuable as beasts of burden. Their milk is rich and yields excellent butter and curd, and the flesh, eaten roasted or dried, is of high quality. The hair is spun into rope and woven into cloth, and the hide is used for leather. Instead of lowing like an ox, the yak utters a low, guttural sound; hence it is called the grunting cow or grunting ox.

YAKIMA, North American Indian tribe of the Shahaptian (q.v.) linguistic stock, formerly occupying considerable territory on the Yakima and Columbia rivers, in eastern Washington, and now living with other tribes on the Yakima Indian Reservation in the south-central part of the State. The Yakima call themselves Waptailmim ("people of the narrows") in allusion to their principal village, which was situated at the narrows of the Yakima R., near present-day Union Gap. They came in contact with traders and missionaries at an early period, and in 1855, with other tribes, made a treaty with the Federal government by which they ceded most of their territory and agreed to settle on the present reservation. Originally, they were salmon fishers, root diggers, berry pickers, hunters, and active traders. They sometimes crossed the Rocky Mts.

to hunt buffalo on the Great Plains. The chief occupations of the modern Yakima, who number about 3000, are farming and livestock raising.

YAKIMA, city in Washington, and county seat of Yakima Co., on the Yakima R., 100 miles s.e. of Seattle. It is an important shipping point and industrial center for the surrounding region, which is noted for its fruit, vegetables, hops, livestock, dairy products, timber, and mineral resources. The chief industrial establishments of Yakima are lumber mills and fruit- and vegetable-packing plants and canneries. In the vicinity are Mount Rainier National Park (q.v.) and the Yakima Indian Reservation. Yakima Valley Junior College (1928) is located in the city. Founded in 1884 by the Northern Pacific Railroad Company, the city was incorporated in 1886 as North Yakima; it adopted the present name in 1917. Pop. (1960) 43,284; (1970) 45,588.

YAKUT, people of the Turkic branch of the Altaic family of languages, living in northeastern Siberia and constituting the majority population of the Yakut A.S.S.R. (q.v.). The Yakut have a somewhat extensive mythology. Although they were in great part converted to Christianity after their subjection by the Russians in the beginning of the 18th century, their original Shamanism (q.v.) still colors their religious life, particularly in the north. The Yakut have not lessened in number as have other Siberian tribes; instead they have multiplied profusely. Their economy is a mixture of the primitive and the modern. Some still follow a nomadic life, hunting, trapping, and fishing. Others, under Russian influence, have adopted modern methods of agriculture and have collectivized such activities as cattle raising. Fishing has been commercialized to some extent. See ALTAIC.

YAKUT AUTONOMOUS SOVIET SOCIALIST REPUBLIC

YAKUT AUTONOMOUS SOVIET SOCIALIST REPUBLIC, autonomous republic of the Soviet Union, on the Central Siberian Plateau. The republic contains 13 percent of the total area of the Soviet Union and extends from the Arctic Ocean in the N. to Stanovoy Range in the S. It is traversed by the Lena, the Yana, the Indigirka, and the Kolyma rivers. The terrain is diversified and includes plains in the W. central section, lowlands in the N., and mountains in the N.W. and S. Winters in the Yakut A.S.S.R. are extremely cold; some of the lowest natural temperatures on record have been registered in the N. part of the republic. Although the summers are relatively warm, the subsoil remains permanently frozen. The chief occupations are fishing, trapping, reindeer breeding, and collecting mammoth ivory in the N.; and farming, stock breeding, and gold mining in the S. The Yakut A.S.S.R. has enormous reserves of timber, and rich mineral deposits exist but, except for gold, these resources have not been exploited because of inadequate transportation facilities. The autonomous republic was established in 1922 in recognition of the national autonomy of the Yakut (q.v.), a Turko-Tatar people who constitute about 80 percent of the population. Area, 1,197,760 sq.mi.; pop. (1970) 664,000.

YALE, Elihu (1649-1721), English businessman and colonial administrator, born in Boston, Mass. The son of an American colonist who re-

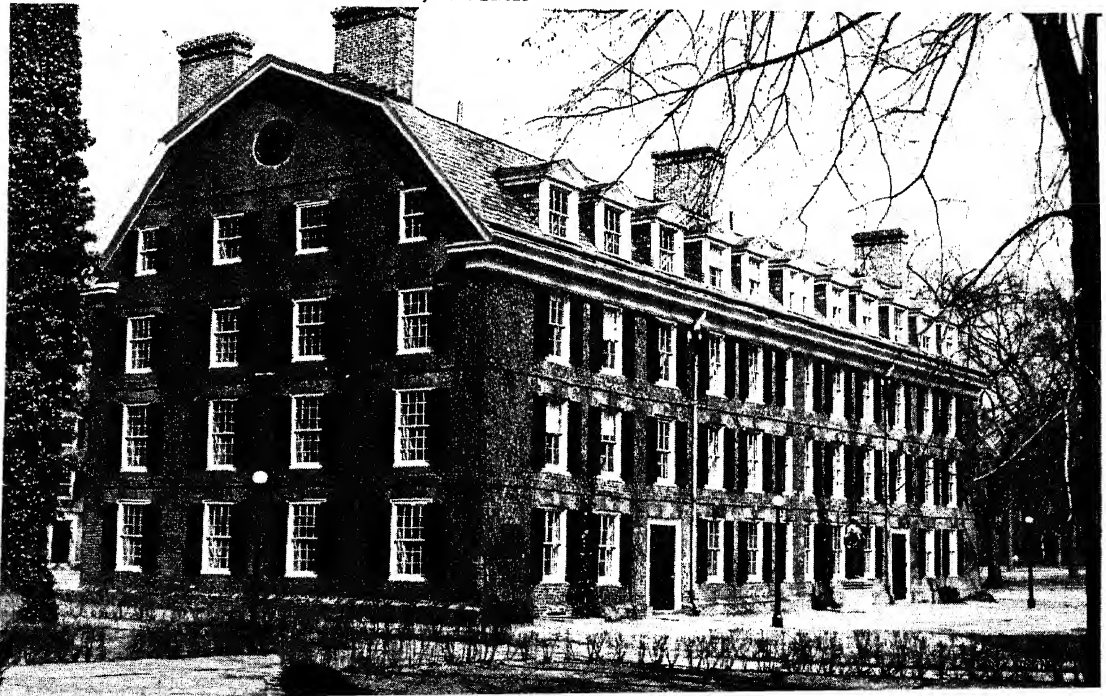
turned to England in 1651, Yale was educated in London. About 1670 he went to Madras, India, as an employee of the English East India Company. Rising rapidly in the company's service, he became governor of Fort Saint George at Madras in 1687. He amassed a considerable fortune in private trade. A scandal touching Yale's administration caused his removal as governor in 1692; he returned to England in 1699 and became a governor of the East India Company (q.v.). Between 1714 and 1721 Yale bestowed books and other goods on the Collegiate School in Saybrook (now Old Saybrook), Conn. They constituted the largest private gift ever made to a college up to that time. In 1716 the school moved to New Haven, Conn. Two years later it was renamed Yale College in honor of its benefactor, and in 1887 it officially became Yale University (q.v.).

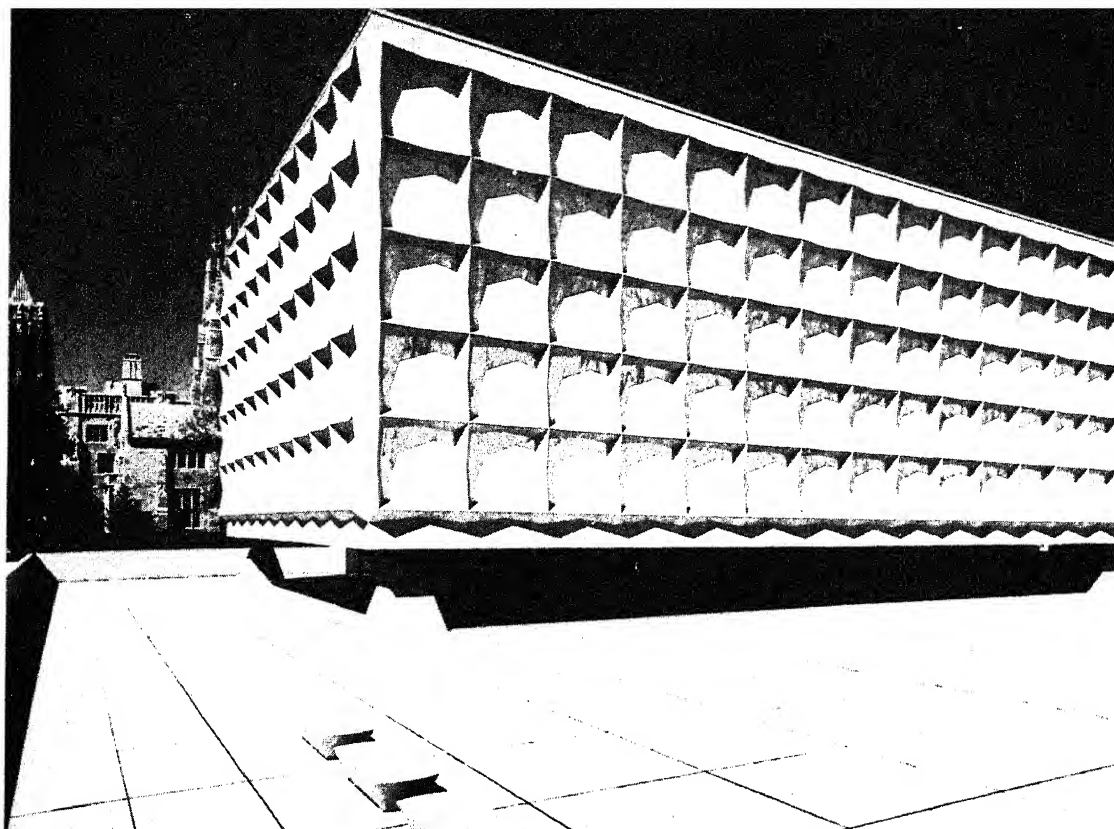
YALE UNIVERSITY, privately controlled co-educational institution of higher learning, the third-oldest in the United States, located in New Haven, Conn. The first classes were held in Clinton, Conn. In 1707 the school was moved to Saybrook (now Old Saybrook), Conn. Nine of the founders were graduates of Harvard College (now Harvard University). In 1716 the school was moved to New Haven, and in 1718 it was renamed Yale College in honor of the merchant Elihu Yale (q.v.), who had made generous gifts to the school.

Undergraduate Activities. Yale College is the oldest division of the entire university and offers courses leading to the degrees of B.A. and

Connecticut Hall, the oldest building on the campus of Yale University, was completed in 1752.

Yale University News Bureau





The Beinecke Rare Book and Manuscript Library at Yale University, dedicated in 1963. Yale University News Bureau

B.S. A five-year B.A. degree is optional. During their freshman year all students live in the dormitories on the "old" campus and are affiliated with the twelve residential colleges where they will live as upperclassmen. The college-residence system, established in 1933 through the generosity of the industrial executive Edward Stephen Harkness (q.v.), of the class of 1897, was designed to give students in a large university the social and educational benefits of living in relatively small groups. Each college accommodates about 250 students, has its own library, kitchen, dining hall, common rooms, and athletic facilities, and is headed by a master and a dean, members of the university faculty who live with their families in the college. A group of fellows, who are also faculty members, assist the master in administering the college's various activities.

Graduate and Professional Divisions. These branches were established as follows: school of medicine (1813), divinity school (1822), law school (1824), graduate school (1847), school of art and architecture (formerly architecture and design, 1865), school of music (1894), school of forestry (1900), school of nursing (1923), school of engineering (1932), and school of drama (1955). The graduate school and the schools of medicine, divinity, law, art, music, and drama

are open to both men and women; the school of nursing is for graduate women and the school of forestry is for men only. The professional schools offer degrees appropriate to their various fields, and the graduate school awards the degrees of M.A., M.S., and Ph.D. The Institute of Occupational Medicine and Hygiene conducts research in occupational diseases. The Labor and Management Center holds special classes in economics and labor relations for representatives of labor unions and industrial concerns. Other divisions of the university are the Bureau of Highway Traffic and the Institute of Far Eastern Languages. The Yale astronomy program is extensive. Yale Observatory, at Bethany observing station, about 15 mi. outside New Haven, is equipped with a 40-in. reflecting telescope. Yale-Columbia Southern Observatory in El Leoncito, Argentina, with a 20-in. double astrograph (refracting telescope), is currently maintained by Yale and the United States Naval Observatory. The Yerkes Laboratories of Primate Biology, Inc., at Orange Park, Fla., are jointly administered by Yale and Harvard Universities (q.v.). New Haven institutions affiliated with Yale include the Berkeley Divinity School and New Haven College. Yale is one of the nine in-

stitutions affiliated as Associated Universities, Inc., on a Federal contract for nuclear research at the Brookhaven National Laboratory (q.v.).

Libraries. The libraries at Yale contain more than 5,800,000 volumes. Most of the books are kept in the Sterling Memorial Library, which houses many special collections in the arts, literature, economics, science, history, and religion. These collections make Yale one of the principal centers for scholarly research in America. Notable recent acquisitions by the university include the William Robertson Coe collection of Western Americana and the manuscript journals of the 18th-century British biographer James Boswell (q.v.). The Peabody Museum of Natural History contains extensive anthropological, archeological, and mineralogical exhibits, and the Gallery of Fine Arts houses noteworthy collections of medieval and Renaissance Italian paintings and early American arts and crafts. The Yale University Press publishes volumes of general and scholarly interest. University publications include the *Yale Review*, a quarterly magazine; the *Yale Daily News*, the oldest American college daily newspaper; the *Yale Literary Magazine*; and the monthly *Yale Law Journal*.

Buildings and Administration. Yale has more than 100 buildings. Connecticut Hall was built in 1752. Harkness Tower, the Payne Whitney Gymnasium, Beinecke Rare Book and Manuscript Library, and Ezra Stiles and Morse colleges are among the other prominent Yale buildings. The university occupies about 1030 acres in and near New Haven. Most of this area is devoted to athletic fields and recreational facilities. Home football games are played in the Yale Bowl, which has a seating capacity of 75,000.

Yale is governed by a nineteen-man corporation consisting of the president of the university; the governor and lieutenant-governor of Connecticut, who serve ex officio; a self-perpetuating body of ten successors to the original trustees; and six alumni fellows elected by the graduates.

Yale College granted its first B.A. degree in 1703. Seventy students were graduated in 1785, the largest Yale class in the 18th century. During the presidency (1795–1817) of the elder Timothy Dwight (q.v.), Yale's scope was widened by the formation of the first professional school. Additional departments were established under Theodore Dwight Woolsey (1846–71), and in 1861 Yale conferred the first Ph.D. degree to be given in the U.S. As the institution grew it gradually became known as Yale University. This name was officially adopted in 1887. During the

presidency (1886–99) of Timothy Dwight (1828–1916), grandson of the earlier President Dwight, Yale's student body, faculty, and endowment more than doubled. A list of the many famous Yale graduates would include the patriot Nathan Hale; men of letters Jonathan Edwards, Noah Webster, James Fenimore Cooper (qq.v.), and Stephen Vincent Benét (*see under* BENÉT); inventors Eli Whitney and Samuel Finley Breese Morse; and statesmen William Howard Taft and Robert Alphonso Taft (qq.v.).

In 1972–73 Yale had a student enrollment of 9000 and a faculty of 1365. Its endowment was about \$457,952,000.

YALTA, city of the Soviet Union, in the Ukrainian S.S.R., on the Black Sea, at the foot of the Crimean Mts., about 30 miles E. of Sevastopol'. One of the principal health and vacation resorts of the U.S.S.R., it is the center of the so-called Soviet Riviera; the average annual temperature is 56° F. In the vicinity are other, lesser resorts, as well as vineyards, orchards, and tobacco farms. Wine, grapes, tobacco, and canned fish are exported. Many of the imposing hotels and sanitariums were residences of Russian nobility before the Bolshevik Revolution.

The ancient Greek colony of Yalita occupied the site of present-day Yalta. After periods of Genoese and Ottoman Turkish control, the town was taken by the Russians late in the 18th century. Yalta became a favorite resort of the czars and the nobility in the 19th century. In February, 1945, during World War II, nearby Livadiya was the scene of the Yalta Conference (q.v.). Pop. (1970) 62,000.

YALTA CONFERENCE, officially, THE CRIMEA CONFERENCE, conference held during World War II, from Feb. 4 to Feb. 11, 1945, near Yalta, Crimea, in the Soviet Union, by President Franklin Delano Roosevelt of the United States, Prime Minister Winston Churchill of Great Britain, and Premier Joseph Stalin (qq.v.) of the U.S.S.R. The Yalta Conference, which marked the high point of Allied unity, followed a similar meeting held in Tehran, Iran, fourteen months earlier (*see* TEHRAN CONFERENCE); it was devoted to the formulation of Allied military strategy and to negotiations on various political problems.

The Yalta Declaration. A communiqué, known as the Yalta Declaration, was issued by the conference on Feb. 11. It disclosed certain decisions reached at the conference, but made no mention of any specific military agreements. With respect to Germany, it declared the intention of the governments represented at the conference to "destroy German militarism and Nazism and to ensure that Germany will never

again be able to disturb the peace of the world"; to "bring all war criminals to just and swift punishment"; and to "exact reparation in kind for the destruction wrought by the Germans". Reference was made in the declaration to a decision to divide Germany, after its defeat, into three zones of occupation and to govern it through a central control commission, situated in Berlin; however, provision was made to invite France "to take over a zone of occupation, and to participate . . . [in] the control commission". Provision was also made for a reparations commission to work in Moscow.

The declaration expressed the determination of the signatories to establish a "general international organization to maintain peace and security", and it announced that "a conference of United Nations" would be held in San Francisco, Calif., in April to establish such an organization. Other agreements relating to the United Nations, made at Yalta but revealed only subsequently, included provisions extending veto power to the five permanent members of the U.N. Security Council, and admitting the Ukrainian and White Russian Soviet Socialist republics to individual membership in the U.N. See UNITED NATIONS, THE.

With respect to the "establishment of order in Europe", the declaration stated the intention of the signatories to respect the principles of the Atlantic Charter (q.v.) and to assist liberated countries or former satellites of the Axis powers (q.v.) in Europe in the formation of democratic interim governments through free elections. The declaration also gave approval to the new government of Yugoslavia (q.v.) and confirmed the possession of eastern Poland (q.v.) by the U.S.S.R., declaring that by way of compensation, "Poland must receive substantial accessions of territory in the north and west", that is, at the expense of Germany. Provision was also made for recognition by the conference members of the Soviet-sponsored Polish government, following its reorganization on a "broader democratic basis". It was also decided that the foreign ministers of the signatory nations would hold periodic meetings; this group of diplomats, which later included the foreign minister of France, became known as the Council of Foreign Ministers.

An important agreement reached at Yalta but not disclosed until later provided for a Soviet declaration of war on Japan within ninety days of the end of the war in Europe; see WORLD WAR II: *Victory over Japan*. After the defeat of Japan, the U.S.S.R. was to receive the southern half of Sakhalin Island, the Kuril Islands, and, on the

Chinese mainland, control of Port Arthur, special privileges in Dairen, and a share in operating the Manchurian railroads; see LÜTA.

The complete text of the Yalta agreements was released in 1947. The U.S. State Department published the record of the conference in *The Conferences at Malta and Yalta 1945* (2 vol., 1955). See also GERMANY: *History: World War II*; POTSDAM CONFERENCE.

YALU or **AMNOK** (Jap. *Oryokko*), river of Asia, forming most of the boundary between North Korea and the People's Republic of China. About 490 mi. long, it rises on the s. slopes of the Changpai Mts., flows in a generally s. and s.w. direction, and empties into Korea Bay, an arm of the Yellow Sea, just s. of Antung (q.v.), China. Among its tributaries are the Hun, Changjin, and Tongno rivers. Navigable only by small craft for most of its length, the Yalu is important as a source of hydroelectric power and as a waterway for the logging industry. Among the Korean cities on its banks are Sinuiju and its port Yongamp'o, Ch'angsŏng, and Hyesanjin. The Yalu figured prominently in the fighting during the Sino-Japanese War (1894), the Russo-Japanese War, and the Korean War (qq.v.).

YAM, common name applied to perennial herbs in the monocot genus *Dioscorea*. The genus, which contains approximately 200 species, is native to tropical regions throughout the world. It is cultivated for its edible tubers, which grow up to 8 ft. long and 100 lb. in size. The inconspicuous white or greenish-yellow flowers, arranged in spikes or racemes, have a six-parted calyx, a six-lobed corolla, six stamens, and a solitary pistil. The fruit is a membranaceous, three-winged capsule. The water yam, *D. alata* is a southeast Asian species commonly cultivated. The Chinese yam, or Chinese potato, *D. batatas*, also known as cinnamon vine, is cultivated in the northern United States as an ornamental climbing vine; its thick tubers reach a length of 3 ft. The air potato, *D. bulbifera*, is native to southern Asia; it bears white flowers and aerial tubers which attain a weight of several pounds. The wild yam, *D. villosa*, native to the eastern U.S., has rootstocks which are not enlarged. Yams are rarely cultivated in the U.S.; the few species grown are limited to Florida and several neighboring States. The name "yam" is commonly but incorrectly applied to varieties of the genus *Ipomoea*; see SWEET POTATO.

YAMAGATA, city in Japan, and capital of Yamagata Prefecture, on Honshu Island, about 180 miles N. of Tokyo. It is a center of silk reeling and also produces iron, copper, and lacquer wares. Among the principal points of interest

YAMASHITA

are a Shinto shrine built in the 8th century A.D. and a castle dating from the feudal period. Pop. (1970) 204,127.

YAMASHITA, Tomoyuki. See *WORLD WAR II: The War Develops Into a Global Conflict: The Fall of Malaya; Decisive Phases of the War Against Japan: Invasion of the Philippines.*

YANCEY, William Lowndes (1814–63), American political leader, born in Ogeechee Shoals, Ga., and educated at Williams College. Moving to Alabama in 1839, he published a weekly newspaper there and served in the State legislature in 1841 and 1843. In 1844 he was elected to the United States House of Representatives, but he resigned in 1846 to organize resistance to the growing antislavery movement. In 1848 Yancey wrote the “Alabama Platform”, a widely influential manifesto calling on Congress to legalize and protect slavery in the territories newly acquired from Mexico. He strenuously opposed the Compromise Measures of 1850 (q.v.) and advocated secession (q.v.) as early as 1851. Through his writings and eloquent speeches Yancey strongly influenced the secession movement; in 1861 he wrote the Alabama ordinance of secession. Shortly before the outbreak of the Civil War the provisional Confederate president Jefferson Davis (q.v.) sent him to Paris and London to obtain aid and diplomatic recognition for the Confederacy. The mission was unsuccessful. Yancey returned to Alabama in 1862 and served in the Confederate senate until his death. See *CIVIL WAR, THE AMERICAN; CONFEDERATE STATES OF AMERICA.*

YANG, Chen Ning (1922–), American nuclear physicist, born in Hofei, China, and educated at the National Southwest Associated University in China and at the University of Chicago. He taught physics at the University of Chicago from 1948 to 1949, when he was invited to do his research at the Institute for Advanced Study, in Princeton, N.J. He was made a permanent member of the institute in 1952 and was full professor from 1955 to 1965. In 1965 he became Albert Einstein Professor of Science at the State University of New York at Stony Brook.

Yang is noted for his work in the field of quantum mechanics (q.v.). With his associate Tsung Dao Lee (q.v.), he proved experimentally that one of the basic quantum-mechanics laws, called the conservation of parity, does not hold true in weak nuclear reactions. In recognition of this achievement Yang and Lee shared the 1957 Nobel Prize in physics. Yang wrote *Elementary Particles* (1962).

YANGCHOW, city of the People's Republic of China, in Kiangsu Province, on the Grand Canal

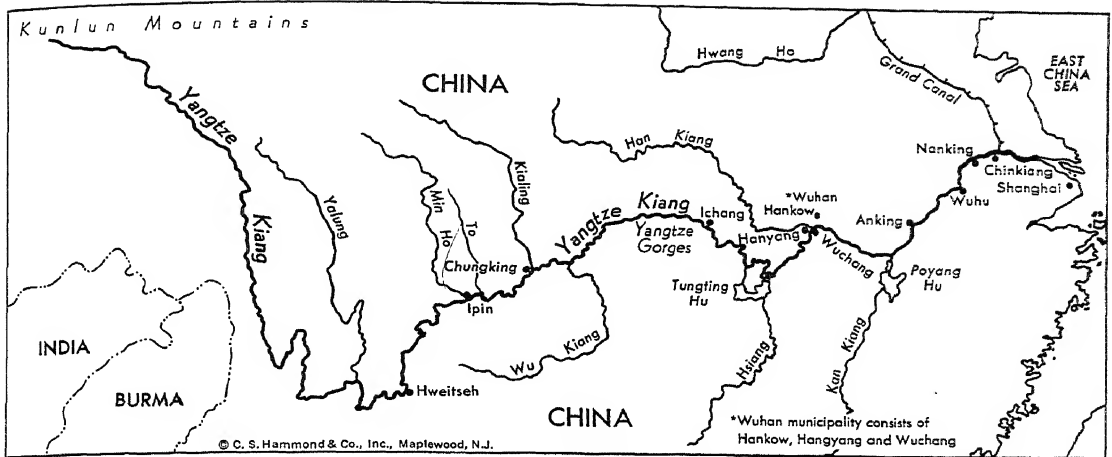
N. of the Yangtze R., 50 miles N.E. of Nanking. A market center, the city processes rice, wheat, cotton, kaoliang sorghum, and vegetables and produces salt and machinery. An imperial palace was built on the site in the 18th century, and the city became a literary center and the home of the Yangchow school of painters; it declined after the Taiping Rebellion in the mid-19th century. Capital of the Yang kingdom of the Sui dynasty in the 6th and 7th centuries, the city flourished under the Tang dynasty of the 7th to 9th centuries. The Italian traveler Marco Polo (q.v.), who knew it as Yangiu, visited it in the 1280's and acted as governor for three years. Known as Kiangtu from 1912 to 1949, when the municipality was established, the city then served as capital of North Kiangsu Province until 1954. The name is sometimes spelled Yang-chou. Pop. (1970 est.) 210,000.

YANGCHÜAN, city of the People's Republic of China, in Shansi Province, on the Taiyüan-Shihkiachwang railroad, 55 miles E. of Taiyüan. It is an iron- and coal-mining center with a blast furnace. The city includes the modern administrative center and, lying to the S.E., Pingting, an iron-working center dating from the 13th century and noted also for its gold, silverware, and pottery. The name is also spelled Yang-ch'üan. Pop. (1970 est.) 350,000.

YANGTZE or YANGTZE KIANG, longest river of Asia, in China, about 3400 mi. in length. It rises in the Kunlun Mts., in the S.W. section of Tsinghai Province, and flows generally S. through Szechwan Province into Yünnan Province, where, in the vicinity of Hweitsch, it bends sharply to the N.E. Then, it flows generally N.E. and E. across central China through Szechwan, Hupei, Anhwei, and Kiangsu provinces to its mouth in the East China Sea, about 14 miles N. of Shanghai.

The headwaters of the Yangtze are situated at an elevation of about 16,000 ft. In its descent to sea level, the river falls to an altitude of 1000 ft. at Ipin, Szechwan Province, the head of navigation for river boats, and to 630 ft. at Chungking. Between Chungking and Ichang (altitude, 130 ft.), a distance of about 200 mi., it passes through the spectacular Yangtze Gorges, which are noted for their natural beauty but are dangerous to shipping. Ichang, 1000 mi. from the sea, is the head of navigation for river steamers; oceangoing vessels may navigate the river to Hankow, a distance of almost 600 mi. from the sea. For about 200 mi. inland from its mouth the river is virtually at sea level.

More than 650,000 sq.mi. of territory are drained by the Yangtze and its branches. The



The Yangtze River and its tributaries.

principal tributaries are the Han, Yalung, Kialing, Min, and To, on the N., and on the S., the Wu; at Chinkiang, the Grand Canal links the Yangtze to the Hwang Ho (q.v.). During periods of heavy rains lakes Tungting and Poyang receive some of the overflow of the Yangtze. Despite these outlets, floods caused by the river occasionally have wrought great destruction of life and property.

With its numerous tributaries and feeders, the Yangtze provides a great transportation network through the heart of some of the most densely populated and economically important areas of China. Among the principal cities on the Yangtze, in addition to those cited in the foregoing, are Wuchang, Nanking, Hanyang, and Anking. Kiangsu Province, largely a deltaic plain consisting of silt deposited by the Yangtze (more than 6,000,000,000 cu.ft. annually), is one of the chief rice-growing areas of China.

Although the entire river (*kiang*) is known as the Yangtze to foreigners, the Chinese apply that designation only to the last 300 or 400 mi. of its course, the portion traversing the region identified with the Yang kingdom (fl. about 10th cent. B.C.). From its upper reaches to Ipin it is called the Kinsha ("Golden Sand"), and various other names are applied in the provinces it traverses. The official Chinese name for the entire river is Chang Kiang ("Long River").

YANKEE, nickname applied in the United States to natives of New England. In most foreign countries the word denotes inhabitants of the U.S. in general.

The 17th-century Dutch settlers of New Netherland (now New York) are said to have derisively nicknamed the English colonists of Connecticut "Janke", the diminutive or familiar form of the Dutch name Jan (John). Some authorities believe that the American Indians orig-

inated "Yankee" by mispronouncing "English" as "Yenghees" or "Yanghies". Another theory links "Yankee" to *eankke*, a Cherokee Indian epithet meaning "coward". Finally, the word may derive from *yankie*, the Gaelic designation for a shrewd, clever woman, which was often applied by Scottish colonists to the sharp traders of New England.

Before 1775 the British sometimes jeeringly called the American colonists "Yankee". Nonetheless, the colonists proudly adopted the word during the American Revolution and made "Yankee Doodle" (q.v.) a patriotic song. During the American Civil War the Southerners referred contemptuously to all Northerners as Yankees or "damyankees". When U.S. troops landed in Europe during World War I, Paris newspapers hailed them as Yankees. The abbreviated form "Yanks" was popularized by the American comedian and playwright George Michael Cohan (q.v.) in his World War I song classic "Over There", with its famous line, "The Yanks are coming".

YANKEE DOODLE, sprightly American patriotic song, especially popular during the American Revolution. The tune is of unknown origin but was probably brought to America by 17th-century emigrants from England, where it was popular as a nursery song. During the latter half of the 18th century it became a favorite colonial air. Supposedly the lyrics were written in 1755 by a British army surgeon stationed in America, Captain Richard Shuckburgh, to poke fun at the unkempt, ill-trained colonial troops. Some authorities believe, however, that the lyrics were actually written twenty years later at the colonial army encampment near Cambridge, Mass. During the Revolutionary War "Yankee Doo-

YANKTON

de" became a popular marching and battle song among Continental troops. The song first appeared in print in *Selection of Scottish, English, Irish, and Foreign Airs*, distributed in 1778 by the Scottish music publisher James Aird (d. 1795). It is still often heard in the United States. **YANKTON**, city in South Dakota, and county seat of Yankton Co., on the Missouri R. near the mouth of the James R., 60 miles s.w. of Sioux Falls. It is an important shipping center for the grain and livestock grown in the area. The principal industrial establishments of the city are creameries, chick hatcheries, grain elevators, and distilleries, and factories engaged in the manufacture of doors, boxes and egg crates, brick, agricultural machinery, and steel conveyors. Yankton is the site of Yankton College (1881) and Mount Marty College (1936). The first permanent settlement, a trading post, was founded on the site of the present-day city in 1858. Yankton was incorporated as a town in 1862 and was the capital of Dakota Territory from 1861 to 1883. The old territorial capitol is now a museum. The city of Yankton was chartered in 1869. Pop. (1970) 11,919.

YAOUNDÉ, city and capital of the United Republic of Cameroon, on the Mfoundi R., 130 miles e. of Douala, on the Gulf of Guinea, with which it is connected by rail. Yaoundé is a road hub in an area producing cacao, bananas, and coffee; gold and titanium mines are also nearby. Manufactures of the city include tobacco products, vegetable oils, dairy and palm products, bricks and tiles, handicrafts, lumber, and soap. It is the site of many government buildings, a municipal stadium, the Pasteur Institute for biomedical research, the University of Yaoundé, a teachers college, a school of administration, foreign embassies, and, on artificially created Yaoundé Lake, a nautical club. Yaoundé was founded in 1888 under the German colonial administration. It became the capital of the French League of Nations mandate of Cameroun in 1922; during World War II it was temporarily displaced as the capital by Douala. From 1960 to 1972, Yaoundé was the capital of the former East Cameroon Province. The name is also spelled Yaunde. Pop. (1972 est.) 190,000.

YAP, atoll of the Caroline Islands of the Pacific Ocean, in the westernmost portion of the group, about 500 miles s.w. of Guam, constituting one of the administrative districts of the Trust Territory of the Pacific Islands, and administered by the United States. Yap comprises four main islands within a lagoon formed by an outer band of islets. The surface of the atoll is mountainous and forested. Most of the inhabitants

are Micronesian. Agriculture and fishing are the main occupations, and copra is the chief export. Large stone disks with holes in the center were the traditional money, but U.S. currency is now commonly used. There are many relics of an early civilization on the atoll. Yap is important internationally as a cable station, being on the direct line between the U.S. and Indonesia.

Discovered by the Spanish in 1791, Yap was a possession of Spain until 1899, when it was sold to Germany. The atoll was occupied by Japan in 1914, upon the outbreak of World War I. On May 7, 1919, it was mandated to Japan by the League of Nations (q.v.) despite the objections of the U.S. government, which protested because of the importance of the cable connections of Yap.

Yap was utilized by Japan as a naval and air base during World War II. American forces bombed the atoll but did not invade it. In 1945, after the war, Japan surrendered Yap to American troops. On Nov. 6, 1946, the U.S. requested that the atoll be placed under United Nations (q.v.) trusteeship with the U.S. as the administering authority. On April 2, 1947, Yap, as a part of the Caroline Islands (q.v.), was placed under the Trust Territory of the Pacific Islands and assigned to the U.S. by the U.N. Security Council. Area, about 80 sq.mi.; pop. of the administrative district (1972 est.) 7530.

YAQUI. See AMERICAN INDIAN LANGUAGES; AMERICAN INDIANS: *Indians of Mexico, Central America, and the West Indies: Northern and Central Mexico*; PIMAN STOCK.

YARKAND (Turk. *Yarkend*; Chin. *Soche*), city and oasis of the People's Republic of China, in Sinkiang-Uigur Autonomous Region, on the Yarkand R., at the n.w. base of the Kunlun Mts., about 650 miles s.w. of Urumchi. The city is an important caravan and highway junction and a center of trade with the Republic of India and the Soviet Union. The principal industries are the manufacture of silk, cotton, and woolen textiles, carpets, and leather goods. Most of the inhabitants are of Turkic stock, and the city, which is encircled by a high, earthen wall, contains many Islamic mosques and educational institutions. The oasis, on the w. rim of the Taklamakan Desert, is an extensively irrigated region. Fruits, oil plants, rice, wheat, barley, and beans are grown, and silk worms and livestock are raised. The oasis also contains deposits of gold and precious stones. The Italian traveler and author Marco Polo (q.v.) visited Yarkand about 1275. Pop. (1970 est.) 80,000.

YAROSLAVL, city of the Soviet Union, in the Russian S.F.S.R., and capital of Yaroslavl Oblast,

at the confluence of the Volga and Kotorosl' rivers, 160 miles N.E. of Moscow. It is an important railroad and industrial center, with industries specializing in the manufacture of machinery, synthetic rubber, asbestos products, and motor vehicles. One of the largest automotive plants in the U.S.S.R. is located in the city. Other industrial plants include textile mills, railroad shops, and shipyards. Yaroslavl was founded in 1024 and was the capital of the Rostov principality from 1218 until 1463. It was an important commercial city during the 16th and 17th centuries. In the 18th century its commerce declined and industry developed. After the Russian Revolution of 1917, Yaroslavl was developed as a center of heavy industry. Pop. (1970) 514,000.

YARROW, perennial herb, *Achillea millefolium*, in the Composite family (Compositae), and known also as milfoil. It is commonly found in pastures and by roadsides throughout the Northern Hemisphere. The plant has an erect stem, from 1 to 3 ft. in height, with finely divided leaves and terminal clusters of small white or red flowers. Red-flowered varieties are widely cultivated as garden plants. Other species of the same genus are sometimes called yarrow.*

YAWATA. See KITAKYUSHU.

YAWL, class of fore-and-aft-rigged sailing vessel, having a mainsail farther forward than in a sloop (q.v.) and a small mizzenmast abaft, or astern, the rudder post; the mizzen sail is smaller than that on a ketch. The term "yaw!" is also applied to a ship's small boat for oarsmen. See also SAIL.

YAWS, or FRAMBESIA or PIAN, common name applied to an infectious tropical disease, caused by the spirochete *Treponema pertenue*, and characterized chiefly by the eruption of disfiguring skin lesions resembling raspberries. The disease is widely distributed throughout the tropical regions of the world. The causative organism was discovered in 1905 by the Italian physician Aldo Castellani (1879–) and is closely related to the spirochete causing syphilis (q.v.). It also produces positive reactions to the serologic tests for syphilis, but yaws, unlike syphilis, is rarely a venereal disease. Infection is transmitted by direct contact with the discharge from lesions of yaws victims. Although not a fatal disease, yaws may cause severe disabling deformities and disfigurement. Most cases begin before puberty, and the disease occurs with equal frequency among males and females.

The incubation period of yaws ranges from three to four weeks. Subsequently a primary lesion develops at the site of infection, generally

on the lower legs. Two or three months later the secondary stage starts with the appearance of widespread groups of small raspberry-like sores similar to the initial lesion. These secondary lesions, which are incapacitating, occur commonly on the palms of the hands and the soles of the feet. The secondary stage may last for more than a year, with new lesions developing as the old ones heal. Unless spontaneous recovery occurs, untreated yaws progresses into the drastic third stage, which is characterized by ulcerative lesions and bone destruction.

Treatment. Treatment for yaws has paralleled the treatment for syphilis, because both diseases respond to the same drugs. In 1948 preparations of long-acting penicillin (q.v.), a single injection of which can cure yaws, were made available; thereafter large-scale control of yaws became a practical, realizable perspective. The World Health Organization (q.v.), in collaboration with the governments of 28 countries, soon instituted a program of mass campaigns to eradicate yaws. In the late 1950's the program was extended to include tropical Africa where an estimated 25,000,000 cases existed at that time.

YAZOO, river of w. central Mississippi, formed by the union of the Tallahatchie and Yalobusha rivers in Leflore Co. It flows 188 mi. in a meandering course, generally s.w., and empties into the Mississippi R. near Vicksburg. The chief tributaries are the Coldwater and the Sunflower. The river, which is navigable for its entire length, traverses one of the richest cotton-growing districts of the United States.

YAZOO FRAUD, term applied to the transaction of 1795 by which the legislature of the State of Georgia granted a large portion of the State's western territory chiefly to four land companies. The latter were called the Yazoo Companies from the Yazoo R., which crosses a section of the deeded region. The consideration was \$500,000, and the area involved was about 35,000,000 acres. It was believed that the members of the legislature voting for the sale had been bribed or were shareholders in the companies. In 1796 a newly elected legislature repudiated the transaction and burned the records pertaining to it; the repudiation was incorporated in the State constitution of 1798.

In 1802 Georgia ceded the disputed territory to the Federal government. The shareholders continued to press their claims and their case finally reached the Supreme Court of the United States (q.v.). In 1810 the Court ruled in favor of the claimants, holding that the sale, although consummated in fraud, could not be invalidated because such action would impair the obliga-

YEAR

tion of a contract. In 1814 the United States Congress approved a final settlement awarding more than \$4,000,000 to the speculators.

YEAR, period of time taken by the earth to complete one revolution around the sun. Because different values are obtained in measuring this period, depending on the celestial object used as a point of reference, several types of year are recognized. The so-called astronomical or tropical year is defined as the time elapsing from the appearance of the sun on one of the Tropics, generally at the vernal equinox, until its return to the same place; see **ECLIPTIC**. The astronomical year has a mean length of 365.2422454 solar days, or 365 days, 5 hr., 48 min., 45.5 sec.; see **DAY**; **MINUTE**.

The so-called sidereal year is the time taken from the sun's eclipse (q.v.) of a given star to the next solar eclipse of the same star, and has a length of 365.2563612 mean solar days, or 365 days, 6 hr., 9 min., 9.54 sec.; see **TIME: Sidereal Time**. The time elapsing from the arrival of the earth at a particular point in its orbit until its return to the same point is known as the anomalous year, and is equivalent to 365.2596425 mean solar days, or 365 days, 6 hr., 13 min., 53.1 sec. The lunar year of 12 lunar months (see **MONTH**), or 354 days, is used in some calendars, notably the Jewish and Muslim calendars. See **CALENDAR**; **CHRONOLOGY**; **ISLAMIC CALENDAR**.

See also **TIME**.

YEAST. See **FUNGI**. See also **BREAD**; **BREWING**.

YEATS, William Butler (1865–1939), major Irish poet and dramatist, born in Sandymount (now part of Dublin). The son of the noted Irish portrait painter John Butler Yeats (1839–1922), Yeats himself studied painting for three years.

First Phase. Following the publication of *Mosada: A Dramatic Poem*, Yeats decided, in 1886, to concentrate on poetry. The year after *Mosada* was published, he moved to London, where he became involved in Indian philosophy, theology, and theosophy (q.v.), and other metaphysical systems and wrote facile, lyrical symbolist verse; see **METAPHYSICS**; **SYMBOLISM**. On one of several visits to Ireland, he met and fell in love with the Irish patriot Maud Gonne (1866–1953), who was responsible for his later involvement in the Irish nationalist cause.

Second Phase. In 1896 Yeats returned to Ireland, and the second phase of his career began. In 1899 he and the Irish playwright Lady Gregory (q.v.) helped to found the Irish Literary Theatre, that eventually became famous as the Abbey Theatre (q.v.). Yeats served as a director and playwright for the Abbey Theatre, helping to develop it into one of the leading theatrical

companies of the world. He was also a prime mover in what is called the Irish literary revival, which commenced at the end of the 19th century, and which was inspired in part by *The Celtic Twilight* (1893), a book in which Yeats retells ancient Irish legends. See **IRISH LITERATURE: Irish Literary Revival**.

The poetry written by Yeats in this period shows a striving to abandon the self-conscious softness and facility of his earlier verse. His



William Butler Yeats

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work becomes clearer and more spare, less mystical and symbolic, in such volumes as *The Green Helmet and Other Poems* (1910). His most important plays of the period are *Cathleen ni Houlihan* (1902), a nationalistic prose drama, and *Deirdre* (1907), a tragedy in verse.

Last Phase. Yeats married in 1917 as the final phase of his work was beginning. From 1922 to 1928 he was an articulate member of the senate of the newly formed Irish Free State, a nationalist but not a revolutionist. Awarded the 1923 Nobel Prize in literature, Yeats accomplished a rare feat among poets. He deepened and perfected his complex, austere style as he grew older; his later writings are generally acknowledged to be his best. *A Vision* (1925), written during this period, is an elaborate prose work attempting to explain the mystical and metaphysical system Yeats applied to most of his writing. It discusses the eternal circle between objectivity and subjectivity, between art and

life, between soul and body, that is the basis of Yeats' philosophy.

The many short plays Yeats wrote at this time are strongly influenced by the *nō* plays of the Japanese theater, employing ritual, masks, choruses, and dance; see JAPANESE DRAMA. Designed to be presented in an intimate theatrical circle, they gained in appreciation and, with the emergence of the new theater techniques of the 1960's, were performed more frequently.

Critique. Yeats is regarded as the greatest Irish poet in the English language and as one of the foremost writers of the 20th century. He brought poetry back to the theater, from which it had long been absent. Fusing strict realism with mystical vision, he created poems as spare and yet as pregnant with mysterious meaning as the images of a dream.

Yeats recounted episodes in his life in *Reveries over Childhood and Youth* (1916), *Four Years* (1921), and *The Trembling of the Veil* (1922), all collected in *Autobiographies* (1927); and *Dramatis Personae* (1936). Of the many collections of his work—which he revised and reworked frequently—the most definitive are the *Poems* (1957), an annotated edition; the *Variorum Edition of the Plays of W. B. Yeats* (1966); *Essays and Introductions* (1961); and *Senate Speeches* (1960). *Memoirs* (1973) includes his journals and a 1914 draft of his autobiography.

See also ENGLISH LITERATURE: 20th-Century Literature: Modern Poetry.

YELLOW, a river in China. See HWANG HO.

YELLOW FEVER, noncontagious, infectious disease, caused by a virus (q.v.), and characterized in severe cases by high fever and jaundice (qq.v.); see INFECTION. Originally yellow fever was believed to be exclusively a disease of man, but research has revealed that the disease also affects monkeys and other animals. It is believed that diseased monkeys of Africa and tropical America are the primary source of infection, and that the disease is transmitted from animal to animal by bites of forest mosquitoes; see MOSQUITO. Such carrier mosquitoes can also transmit the infection to man. This type of the disease, which occurs only sporadically in human beings, is known as jungle yellow fever. If an infected individual moves into a populated area, moreover, he may be bitten by a semi-domestic species of mosquito, such as *Aedes aegypti*. As members of such species live close to human habitations and feed on the blood of man, they are thus the chief transmitting agents, in epidemics of urban yellow fever.

History. Nothing definite is known about the origins of yellow fever, but it is probable that

the disease first appeared in West Africa and that it was brought to America at the time of the slave trade. The disease was first described medically during the 17th century, when an outbreak was observed in the Yucatán Peninsula, Mexico. In the same century epidemics were recorded in Brazil and the West Indies. Ultimately yellow fever spread to the United States, Spain, and other countries; serious epidemics occurred in various coastal cities, including New York City and New Orleans, La., during the 19th century. With the development of rail transportation, inland areas also were attacked by the disease.

In 1881 the Cuban physician Carlos Juan Finlay (q.v.) advanced the hypothesis that yellow fever was transmitted by mosquito bites. Finlay's theory was verified in 1901 by the work of several investigators, notably the American bacteriologist Walter Reed (q.v.), who also proved the agent to be a virus. Thereafter, on the basis of their findings, the disease was brought under control by advanced methods of sanitation, including drainage of mosquito breeding grounds and quarantine (q.v.) of ships arriving from infected areas. Yellow fever was not recognized as primarily a jungle disease until 1932.

Symptoms. The average incubation period of yellow fever is three to six days. The disease often occurs in a mild form without symptoms. In severe cases, the onset is generally sudden with typical symptoms of headache, backache, and fever. The first stage is also characterized by nausea, vomiting, and presence of albumin (q.v.) in the urine. After the initial fever, the temperature usually returns to normal, but on the fourth or fifth day, when the second stage of the disease begins, the temperature again rises. The second stage is marked by jaundice, hemorrhage from mucous membranes, vomiting of blood (the characteristic, so-called black vomit of yellow fever), and fatty degeneration of the liver, kidneys, and heart. The destruction of liver cells results in the accumulation of yellow bile (q.v.) pigments in the skin, giving the disease its name. Death usually occurs between the fourth and eighth day after the onset. In cases of spontaneous recovery, convalescence is rapid, although jaundice may persist for some time. The disease never recurs, one attack providing immunity (q.v.) for life.

Prevention. No specific treatment presently is known for yellow fever. Elimination of the yellow-fever mosquitoes is the most effective means of preventing the disease. In 1939 the South African physician Max Theiler (q.v.) developed a vaccine which confers immunity on

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individuals exposed to the disease. Vaccination (q.v.) is today required for all persons traveling between endemic regions and other parts of the world.

In 1956 dead monkeys infected with the virus were found in Guatemala near the Mexican border. The Mexican government immediately instituted a large-scale campaign to eradicate the *Aedes aegypti* mosquitoes. Public health officials have pronounced the southern third of the U.S. a danger zone, since yellow-fever mosquitoes are still prevalent in that region.

See also MALARIA.

T.H.W. & D.S.T.

YELLOWHAMMER, small European perching bird, *Emberiza citrinella*, of the Finch family, Fringillidae; see BUNTING. Also known as the yellow bunting, the yellowhammer is about 6½ in. long and nests near the ground in open fields.



Yellowhammer, *Emberiza citrinella*

Allan D. Cruickshank-
National Audubon Society

The male is bright yellow with brown spots on the back and top of the head and has blackish quills in the tail. The name is also applied to two North American birds, the yellow-shafted flicker and the crested flycatcher. See FLICKER; FLY-CATCHER.

YELLOW JACKET. See HORNET.

YELLOWKNIFE, city and territorial capital of Northwest Territories, Canada, situated in central Mackenzie District on the N. shore of Great Slave Lake. Yellowknife became the capital in 1967, when administration was transferred from Ottawa. The city is the embarkation point for bush planes serving the Canadian Arctic, where significant discoveries of oil have been made.

Two of Canada's largest gold mines are located near Yellowknife. It is connected by highway to N. Alberta and by boat to other communities on the shores of Great Slave Lake.

Yellowknife was briefly a fur-trading outpost in the early 19th century. Miners on their way to the Klondike found gold nearby in 1896, but the town did not come into existence until after pitchblende was discovered in 1930. Further discoveries of gold in 1934, and in 1943-45, boosted the city's economy and population. In 1970, Yellowknife was incorporated as a city, the first in the Northwest Territories. Pop. (1976) 8256.

YELLOWLEGS, either of two species of American shore birds, belonging to the genus *Totanus* and to the Sandpiper family, Scolopacidae; see SANDPIPER. The greater yellowlegs, *T. melanoleucus*, is 15 in. long and has a long, slender, slightly upturned bill and long, yellow legs. The upper parts are dark gray patterned with white stripes and spots; the lower parts are white with dusky markings on the throat and breast. The female lays four spotted, buff-colored eggs in a clutch placed in a natural depression in the ground. The lesser yellowlegs, *T. flavipes*, which is 11 in. long, differs principally in its smaller size.

The yellowlegs have an extensive range, breeding in northern North America and wintering as far south as southern Argentina. They frequent inland grassy marshes and coastal beaches, feeding on insects, minnows, and crustaceans. Yellowlegs congregate with various other shore birds and, when danger impends, they are the first to raise an alarm, flying off with sharp warning cries. Although once hunted, these birds are now protected by Federal law.

YELLOW SEA (Chin. *Hwang Hai*), arm of the Pacific Ocean, lying between the N.E. coast of China and the W. coast of Korea, and merging with the East China Sea on the S. Po Hai Strait, which separates Shantung and Liaotung peninsulas, provides access to the Gulf of Chihli and the Gulf of Liaotung. Korea Bay, the N.E. extremity of the Yellow Sea, lies between Liaotung Peninsula and Korea. The greatest width of the sea is about 400 mi.; it is comparatively shallow, the greatest depth being less than 300 ft. Among the rivers emptying into the Yellow Sea are the Hwang Ho, the Yalu, and the Han. A number of small islands are found off the Korean coast and extensive sand shoals are near the Chinese coast. Major ports on the sea include Chefoo, Lüta, Tientsin, Tsingtao, and Yingkow, all in China; Chinnampo, in North Korea; and Inch'ön, in South Korea. The Yellow Sea takes its



Bison wintering along the Firehole River in Upper Geyser Basin, Yellowstone National Park.

Bob and Ira Spring

name from the yellowish discoloration caused by the vast amount of sediment deposited by the Hwang Ho.

YELLOWSTONE, river of Wyoming and Montana, rising in N.W. Wyoming. In the first part of its course the river flows generally northward and crosses Yellowstone National Park (q.v.), where it forms Yellowstone Lake and the Grand Canyon of the Yellowstone. The Yellowstone traverses S. and E. Montana and empties into the Missouri R. on the Montana-North Dakota boundary. The river, 671 mi. long, is navigable for about 300 mi. and drains an area of 70,400 sq.mi. The chief tributaries are the Big-horn, the Tongue, and the Powder rivers.

YELLOWSTONE NATIONAL PARK, oldest and largest national park in the United States. The park, established by an act of Congress on March 1, 1872, covers an area of 2,221,772.61 acres, chiefly in N.W. corner of Wyoming, but extending into Idaho and Montana. The area is part of the central Rocky Mts. (q.v.). Within the park are spectacular geysers, hot springs and other thermal phenomena resulting from continual volcanic activity, extensively forested regions, lakes, rivers, waterfalls, canyons, and meadows. In the heart of the park lies a broad plateau, with an average elevation of 8000 ft.

above sea level, surrounded by lofty and rugged mountain ranges. Several peaks in the park are more than 11,000 ft. above sea level. Among these are Pollux Peak (11,067 ft.), Electric Peak (11,155 ft.), and Eagle Peak (11,360 ft.).

Plants and Animals. The central basin consists of lava fields, into which run spurs from the mountains. The continental divide crosses the park in an irregular line from the middle of the W. boundary to near the S.E. corner, so the waters of the park flow to both oceans. The forests are mostly coniferous, with some birches, willows, and aspens. The most common tree is the lodgepole pine; other conifers include the alpine fir, Engelmann's spruce, Douglas fir, limber pine, whitebark pine, and Rocky Mountain juniper. Smaller plant life is typical of that found in mountainous areas, and sagebrush (q.v.) grows on some of the plateaus.

Hunting is prohibited in the park, which is one of the greatest wildlife refuges in the world. Among the kinds of animals in the park are deer, bear, elk, antelope, mountain sheep, bison, moose, coyote, fox, wolf, lynx, panther, beaver, muskrat, marten, weasel, marmot, mink,



Wild bull moose at the mouth of Pelican Creek, Yellowstone National Park. The Rocky Mountains can be seen in the distance.
Bob and Ira Spring

otter, skunk, badger, and squirrel. More than 200 species of birds are found in the park, including eagles, wild geese and ducks, ospreys, pelicans, gulls, hawks, and trumpeter swans, which were once thought to be extinct. The waters of the park abound in fish, especially trout, of which there are a great variety, and whitefish, grayling, and chub.

The Yellowstone River. The Yellowstone R. enters the park in the s.e. corner and flows N., first into Yellowstone Lake and then through the famous Grand Canyon of the Yellowstone into Montana, eventually emptying into the Missouri R. Yellowstone Lake, lying 7731 ft. above sea level, is the largest body of water in North America at so great an altitude. It covers 137 sq.mi. and has a shore line of about 100 mi. The maximum depth is 300 ft. The shores are densely forested, with numerous lofty peaks on the E.

The river descends into the Grand Canyon of the Yellowstone in two spectacular falls, about 110 and about 312 ft. in height, respectively. The canyon is one of the most spectacular features of the park, with brilliantly colored walls that rise abruptly to as high as 1100 ft. above the rushing river. Yellow, green, orange, and glowing shades of red, from deep crimson to soft pink, band the volcanic rock of which the walls are formed. Inspiration Point, projecting almost into the center of the canyon, is a famous van-

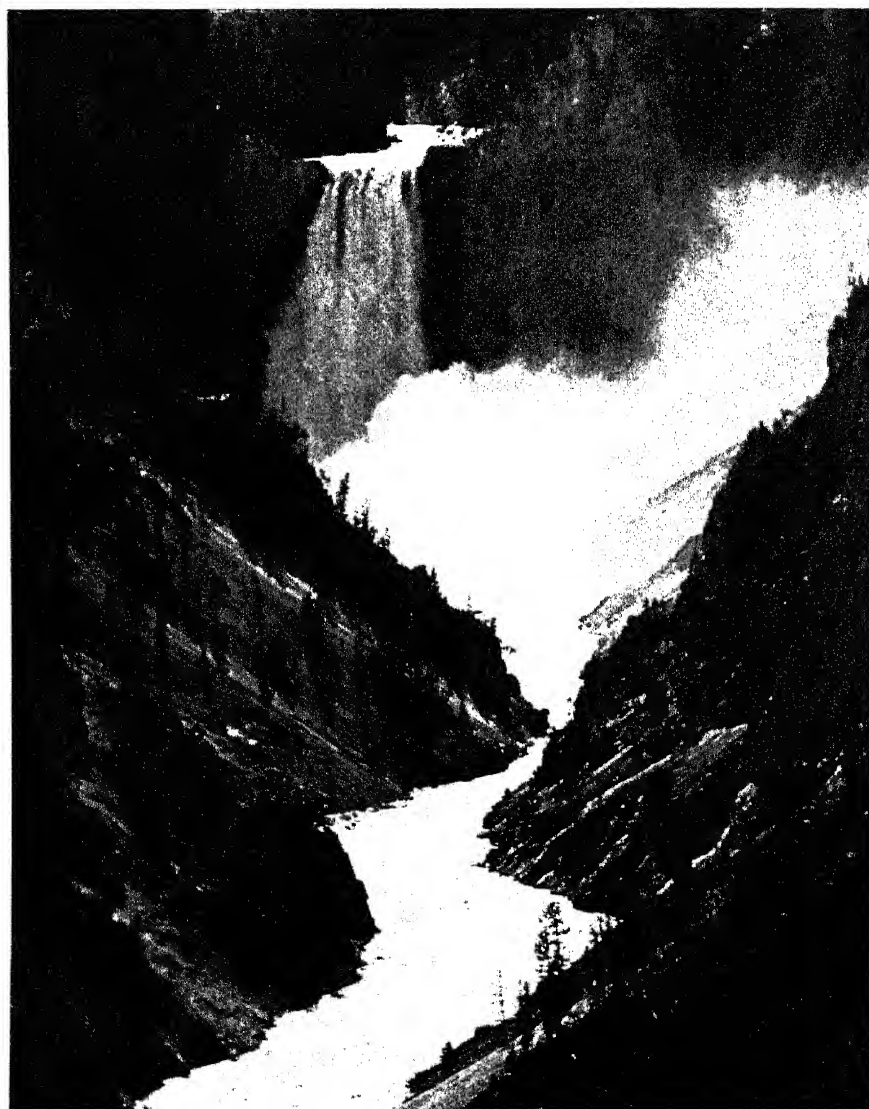
tage point for a panoramic view of the canyon and the waterfalls.

Geysers. The best known features of the park are the more than 3000 geysers (see GEYSER) and hot springs. The geysers are contained in six major basins, Norris, Lower, Midway, Upper, Heart Lake, and Shoshone basins, in the w. and s. central region of the park. Yellowstone contains more geysers than are found in the rest of the world combined, as well as the largest in the world. Among the most celebrated individual geysers are Old Faithful, which erupts for about 4 minutes at intervals of between 37 and 93 minutes (the mathematical average is 65 minutes) in a column of steam and hot water rising as high as 170 ft. and totaling from 10,010 to 12,000 gallons of water at each eruption; the Giant, largest geyser of the park, which erupts at irregular intervals, throwing up a jet of hot water more than 200 ft. in height; and the Giantess, erupting for about 4 hours approximately twice a year in a column 200 ft. high. The Excelsior geyser, which ceased erupting in 1888, is said to have been the most violent in its eruptions. Other thermal attractions in the park include hot springs and mud volcanoes. In many cases the minerals and algae in these hot springs have been deposited



Yellowstone National Park. Plate 1. *Old Faithful, one of the park's famous attractions, shoots hot water and steam about 170 ft. into the air, erupting on an average of about once every 65 minutes.*

National Park Service



Yellowstone National Park. Plate 2. Above: Trails, mapped throughout most of the park, provide many exhilarating horseback trips for tourists. Left: The Yellowstone River drops more than 300 ft. over the Lower Falls into the Grand Canyon of Yellowstone. National Park Service



The common yellowthroat, *Geothlypis trichas*, is a small warbler found throughout North America.

Michel Kleinbaum—Peter Arnold

by the waters on the surrounding ground, building up cones and terraces, often in brightly colored formations. The most famous noneruptive springs are the Mammoth Hot Springs, situated near the N. entrance of the park. These springs cover an area of about 2000 acres and contain terraces as high as 300 ft.

Other points of interest include Cascades of the Firehole (60 ft.), Tower Falls (132 ft.), Golden Gate Canyon, and Obsidian Cliff, a black glass formation 165 ft. high. An unusual feature of the park is the fossil forests, in which successive generations of trees have been buried and petrified under flows of ashes, mud, and other volcanic material.

History. Yellowstone National Park was discovered about 1807 by the American trapper John Colter (about 1775–1813), and it became a source of frontier legend and up to 1860 almost a myth. The area was not fully explored and described until an expedition organized by the State of Montana in 1870 confirmed the stories of explorers and fur traders. In 1872, because of a survey made by the American geologist Ferdinand Vandeveer Hayden (1829–87) in charge of a geological survey of the territories of the U.S., the region was made a national park in order to guard against private exploitation of its wonders.

Motor roads, horseback and hiking trails, hotels, lodges, camping grounds, and museums are maintained for tourists. Because of the rigorous climate, the official season during which all park facilities are operated extends only from June 20 to September 10. The N. entrance, however, and 60 mi. of roads are kept open all year for sightseeing and skiing.

The park is administered by the National Park Service (q.v.).

YELLOWTAIL, streamlined marine game fish, *Seriola dorsalis*, of the Jack family, Carangidae, found along the Pacific coast of North America from northern California to Mexico. It weighs as much as 20 lb., but specimens as large as 80 lb. have been recorded. The top of the yellowtail is blue and the bottom silvery blue, with a yellowish stripe along each side and a golden tail. It feeds at the surface on crustaceans and on fast-swimming prey such as herring, sardines, and mackerels.

YELLOWTHROAT, either of two species and many subspecies of North American wood warblers of the genus *Geothlypis*; see WOOD WARBLER. The most familiar species is the common yellowthroat, *G. trichas*, which breeds throughout North America. In winter it ranges from North Carolina, Louisiana, and California to Mexico and the West Indies. The adult male is small, about 5 in. long. It is colored olive green above, with a bright yellow throat and chest, and has a masklike black band across the face. The female is similar, but lacks the masklike black band. Yellowthroats inhabit thick brush or marshes and dart about restlessly in search of food, which consists mainly of insects. Their cry, *whitchity, whitchity, witch*, is loud and vigorous. The female usually lays four white, speckled eggs in a nest that is built of grass and twigs close to the ground.

YELLOWWOOD, AMERICAN, leguminous flowering tree, *Cladrastis lutea*, native to the

YEMEN ARAB REPUBLIC

southeastern United States, and known also as gopherwood and virgilia. A hardy, smooth-barked tree which attains a maximum height of 60 ft., it bears large terminal panicles of fragrant white flowers. The leaves are compound and bright green. The tree is used extensively in landscape gardening, and its wood yields a yellow dye.

YEMEN ARAB REPUBLIC, commonly **YEMEN** or **NORTHERN YEMEN**, country of Asia, in the s.w. corner of the Arabian Peninsula. It is bounded on the n. by Saudi Arabia, on the e. by the People's Democratic Republic of Yemen (Southern Yemen), and on the w. by the Red Sea. The country lies between about lat. 13° N. and lat. 17°10' N. and long. 42°30' E. and long. 47°20' E. The area is about 75,000 sq.mi.

THE LAND

The country is essentially mountainous. Except for the semidesert coastal plain, the Tihama, which runs the entire length of the territory and averages 30 mi. in width, the country is composed of fertile highland plateaus rising from 4000 to 10,000 ft. in height. Jebel Hadhur, the highest point in the country, rises to about 12,336 ft. above sea level. The highlands are broken up by wadis or river valleys that are dry in the summer.

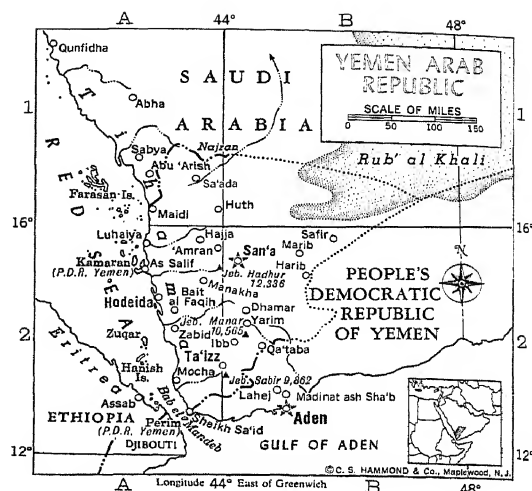
The climate along the coast is very hot and humid. Winds blowing n.w. in the summer and s.w. in winter bring severe sandstorms and very little rain. The highlands have a temperate climate and the winters are cool. Temperatures vary from 71° F. in June to 57° F. in January. Rainfall in the highland regions ranges from about 16 to 30 in.

THE PEOPLE

The highland Yemenites are principally of Arab descent. The people of the Tihama coastal strip are of mixed Arab and African origin. Agriculture is the major occupation. No census has ever been taken in Yemen; according to a United Nations estimate (1971), the population was 5,900,000. The overall density is about 75 per sq.mi. (U.N. est. 1970).

The capital is the walled city of San'a (pop. 1970 est., 130,000). Other important cities, with estimated populations, are the Red Sea port of Hodeida (94,000) and Ta'izz (85,000).

Religion and Language. Almost the entire population are followers of Islam. The people of the n., central, and e. portions of the country are mainly the Zaidi community of the Shi'ite sect and those in the s. and s.w. parts are the Shafa'i community of the Sunnite sect (see **MUSLIM SECTS**). The language used throughout the country is Arabic.



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Education. Education is provided mainly by the traditional religious schools of Islam. Classes are generally free and are taught by scholars of the Koran called *ulamas*. In the early 1960's a modern educational system was introduced on a limited scale. The plan called for 6 years of primary school, 4 years of intermediate school, and 3 years of secondary school.

Higher and specialized education is carried on by 1 agricultural school, 6 vocational schools, 1 military academy, 1 radio telecommunications college, 1 college of aviation, and 4 religious colleges. The Library of the Great Mosque of San'a has in its collection 10,000 manuscripts.

THE ECONOMY

The extremes of topography permit a wide variety of agriculture including grains, cotton, many kinds of fruit, and qat, a mildly narcotic leaf. Dry farming is practiced in extensive terraced fields of the highlands. Principal crops are millet, corn, oats, barley, sorghum, rice, almonds, and grapes. A considerable amount of livestock breeding, especially of sheep, goats, horses, donkeys, cattle, camels, and mules, is practiced.

YEMEN ARAB REPUBLIC

Local industries consist of weaving, tanning, spinning, and handicrafts. In 1955 an American group was granted oil and mineral concessions, but political turmoil prevented exploitation. Large copper deposits were discovered in 1969 near Ta'izz, and in 1972 petroleum was found in the Tihama; both minerals remained unexploited in the early 1970's. The government controls all major trade and industrial organizations, including those relating to foreign trade, energy, and cotton.

Yemen receives considerable aid from the Soviet Union and West Germany. Another source of economic aid was the United States. In April, 1967, however, because of political difficulties, this aid was terminated and all American foreign aid personnel were withdrawn. Between 1959 and 1967 about \$42,000,000 was granted to Yemen by the U.S.

The unit of currency is the riyal (4.6 riyals equal U.S.\$1; 1975). In a recent year budget figures showed about \$25,000,000 in revenue and \$29,000,000 in expenditures.

The main imports of Yemen are rice, flour, pe-

troleum, machinery, textiles, iron, and steel. The exports are coffee, qat, salt, hides and skins, foodstuffs, and agate. In the early 1970's exports totaled about \$8,000,000, and imports amounted to about \$125,000,000.

Highways connect San'a to Hodeida, and Mocha with Ta'izz, and San'a. The Yemen Navigation Company runs cargo and passenger service to various African and Middle Eastern ports. Modern port facilities were constructed at Hodeida in the early 1970's. The Yemen Airlines operates domestic flights and services to Saudi Arabia. Egyptian and Ethiopian airlines connect Yemen with Africa. In 1973 San'a airport was rebuilt to accommodate late-model aircraft.

Yemen has four newspapers: three in San'a and one in Ta'izz. The state-controlled broadcasting service is located in San'a.

GOVERNMENT

Yemen is an Islamic Arab sovereign republic. The first permanent Yemeni constitution, pro-

The eastern section (also known as the old city) of San'a, capital of the Yemen Arab Republic.

Diane Rawson-Photo Researchers





As in many other Arabic countries, the women of Yemen wear heavy veils in public. UPI

mulgated in December, 1970, replaced a series of interim constitutions issued between 1962 and 1967. Legislative authority is vested in a 179-member consultative council; 20 members are chosen by the president and the others are elected by general franchise. The council members have four-year terms. Executive power rests with a five-member presidential council that is selected by the consultative council; the presidential council has a rotating chairman. The constitution was suspended following a coup d'état in June, 1974; see *History*, below.

HISTORY

In ancient times the region comprising present-day Yemen was considered part of Arabia Felix (Happy Arabia). Before the Christian era Minaeans, Sabaeans (see *SHEBA*), and Himyarites (q.v.) successively held sway in the region. Christianity and Judaism were introduced into the area in the 4th century A.D. Ethiopian rule was established for a period beginning about 340 and again in the 6th century. The Persians superseded the Ethiopians around the year 575, and in 628 the inhabitants were converted to Islam. Subsequently Yemen was part of the Arab caliphate until about 900, when it seceded.

At that time the Rassite dynasty of the Zaidi Shi'ites established control, and it was from the Rassite dynasty that the last ruler (imam) in the 20th century was descended. Ottoman Turkish rule, which began in the 16th century, was interrupted in the 17th century, and reestablished in the late 19th century. After years of rebellion the imam of Yemen was finally granted autonomy by Turkey in 1913. He received British recognition in 1925. Great Britain signed a treaty guaranteeing the independence of Yemen in 1934.

Recent Events. Yemen was a founder in 1945 of the Arab League (q.v.). The country joined the United Nations and established relations with the U.S. in 1947. On March 8, 1958, Yemen and the United Arab Republic, now the Arab Republic of Egypt, formed a loose affiliation, under the name United Arab States; it remained in effect until Dec. 26, 1961. On Oct. 13, 1961, the imam, Ahmad Seif al-Islam (1891?-1962), who had been seriously wounded in an attempted assassination on the previous March 27, delegated his virtually absolute ruling powers to his son Mohammed al-Badr (1926-). The imam died on Sept. 19, 1962; Mohammed al-Badr succeeded him as the imam of Yemen.

On Sept. 27, an army coup d'état overthrew the royal government and a republic was proclaimed under the leadership of Colonel Abdullah al-Sallal (1917-). The deposed imam, who fled to Saudi Arabia, retained the loyalty of some Yemenite tribesmen and received pledges of support from Saudi Arabia and Jordan in his efforts to regain his throne. Fighting between republican troops and royalist forces continued throughout 1963 and 1964 and involved hostilities between the U.A.R., which aided the republicans, and Saudi Arabia, which gave support to the royalists.

With a view toward the eventual unification of their governments, on July 13, 1964, the Yemen Arab Republic and the U.A.R. signed an agreement to coordinate their policies. Signs of unrest within the Yemeni republican government were reported in late 1964, and cabinet shifts were frequent in 1965. During the latter year U.A.R. President Gamal Abdel Nasser (q.v.) accepted an invitation extended by Faisal (q.v.), King of Saudi Arabia, for a conference to consider a settlement of the Yemeni civil war. The conference resulted in an agreement signed Aug. 24, 1965, whereby both countries pledged to end their involvement in the war and to arrange for a plebiscite to permit the people of Yemen to choose their form of government. Several peace conferences were scheduled, the



Yemen. Plate 1. The adjoining states of Yemen Arab Republic and Peoples Democratic Republic of Yemen are separate political entities, but the lands and peoples are strikingly similar. Above: A Yemeni family group; the majority of the people are Muslim Arabs, and Arabic is the principal language. Below: Nomads in the coastal regions tend flocks of goats.

FPG





Yemen. Plate 2. Left: Yemeni arts and crafts include the making of artfully curved and ornamented daggers. Below: Colorfully attired Yemeni men, equipped with musical instruments as well as weapons, are a reminder of the unrest in the contemporary Arab world. FPG



YEMEN, PEOPLE'S DEMOCRATIC REPUBLIC OF

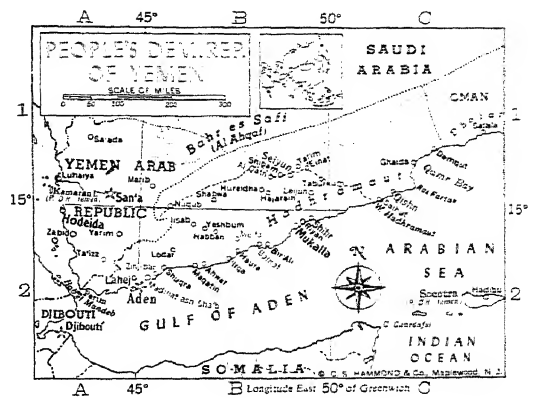
first of which opened on Nov. 23 and adjourned in a deadlock on Dec. 25. The second conference, scheduled for February, 1966, was not held, and on Feb. 22 it was reported that U.A.R. planes aided Yemeni republican forces against royalists in the first outbreak of fighting since the August, 1965, truce.

During 1966 the U.A.R.-Saudi Arabia confrontation intensified in direct proportion to the increase of the buildup of U.A.R. forces. Despite the growing U.A.R. presence, however, the republican regime was unable to overcome the guerrilla-type warfare of the royalists. Meanwhile, friction developed in the republican ranks between Premier Hassan al-Amri and President Sallal, who had returned to Yemen in September, 1966, after having had a long stay in the U.A.R. Sallal purged the government and the military.

The Arab defeat by Israel in the June, 1967, war brought basic changes in Yemen. In August, 1967, at the Arab foreign ministers' meeting at Khartoum, the U.A.R. government proposed withdrawal of troops from Yemen, and by Aug. 31, President Nasser and King Faisal had reached a definitive agreement. Despite Sallal's opposition, by the end of 1967 U.A.R. troops had withdrawn from the country. Subsequently, Sallal was overthrown by Amri; he was replaced as president by Qadi Abdul Rahman al-Iryani. Overtures to the royalists were made, but without concrete results; a royalist offensive in early 1968 was successfully resisted by the republicans. In 1972 government forces clashed briefly with troops of Southern Yemen (see YEMEN, PEOPLE'S DEMOCRATIC REPUBLIC OF).

Claiming that the government had become unworkable because of a prolonged clash between President al-Iryani and the consultative assembly, military officers led by Colonel Ibrahim al-Hamidi staged a bloodless coup d'état in June, 1974. The constitution was suspended, and executive power was vested in the Command Council, dominated by the military.

Colonel Hamidi, who assumed the presidency in 1975, was assassinated in October, 1977. He was succeeded by Army Chief of Staff Ahmed Hussein al-Ghashmi. He in turn was killed in June, 1978, by a bomb hidden in the briefcase of a visiting diplomat from Southern Yemen. Lieutenant Colonel Ali Abdullah Saleh was then chosen president. Relations with Southern Yemen subsequently remained tense and frequently erupted in heavy border fighting. Nevertheless, on March 29, 1979, the two countries provisionally agreed on a plan for their unification. No timetable was announced.



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YEMEN, PEOPLE'S DEMOCRATIC REPUBLIC OF, formerly PEOPLE'S REPUBLIC OF SOUTHERN YEMEN, commonly SOUTHERN YEMEN, country of Asia, on the s. coast of the Arabian Peninsula. It is bounded on the n. by Saudi Arabia, on the e. by Oman, on the s. by the Gulf of Aden, and on the w. by the Yemen Arab Republic. Southern Yemen includes the islands of Socotra (q.v.) in the Arabian Sea, Kamaran in the Red Sea, and Perim (q.v.) in the strait of Bab el Mandeb. The country is situated between about lat. 12°40' N. and lat. 17° N. and about long. 43°40' E. and long. 53°30' E. Estimates of the total area vary from 61,890 sq.mi. to 112,000 sq.mi. because the boundaries with Saudi Arabia and Oman have not yet been determined.

The Land. The terrain consists of a narrow, sandy coastal plain, and a mountainous interior broken by deep valleys. The largest valley is Hadhramaut (q.v.) in the central area. The climate throughout the country is extremely hot, with summer temperatures exceeding 130° F.

YEMEN, PEOPLE'S DEMOCRATIC REPUBLIC OF

The average annual rainfall is less than 3 in. The country is arid and barren, except for some fertile valleys and floodplains.

The People. The population is composed primarily of Arabs. Minority groups include Indians, Pakistanis, and Somalis. More than 90 percent of the people are Muslims. The principal language is Arabic, and English is widely spoken. According to the 1973 census, the population was 1,590,275. The overall population density is about 13 per sq.mi. (1973 est.). The national capital, largest city, and major port is Aden, with a population (1973 est.) of 264,326. Madinat ash Sha'b, the former administrative capital, has about 20,000 inhabitants.

Education is free. In the early 1970's some 105,000 pupils were attending primary schools; secondary schools had about 12,300 students, and 235 were in teacher-training colleges.

The Economy. The economy is based on agriculture, except in Aden, where employment is provided by the port facility and an oil refinery. The major crops include barley, dates, millet, sorghum, and wheat. The only crop grown for export is long-staple cotton; annual production in the early 1970's was about 5000 tons. Agricultural development projects, especially irrigation and land reclamation, are under construction. About 50,000 acres of uncultivated land have been placed under irrigation. The raising of livestock is also a major occupation. In the early 1970's livestock included about 885,000 goats, 225,000 sheep, 92,000 cattle, and 40,000 camels. The fishing catch in the early 1970's was about 123,000 tons, mostly sardines and sharks.

Manufacturing and trade are concentrated in Aden, where the port facility and a British-built oil refinery are located. In the early 1970's the annual production of refined petroleum products totaled about 3,365,000 tons; more than half constituted bunker fuel for ships calling at Aden. In the late 1960's the economy of Yemen encountered serious problems as a result of the British withdrawal from the country in 1967 and the closing of the Suez Canal in the same year. The production of petroleum products was reduced by about 2,000,000 tons, and the revenue from shipping was drastically curtailed.

The unit of currency is the dinar, which is divided into 1000 fils (.345 dinar equals U.S.\$1; 1976). In a recent year government expenditures totaled \$48,649,000 compared to revenues of \$35,135,000. The government looked to Great Britain to meet much of the difference; British aid was continued until May, 1968, when Yemen rejected a reduced British amount. Since then some economic assistance has been provided

by Iraq, Libya, the Soviet Union, and Yugoslavia.

Transportation and Communications. The country has about 2680 mi. of roads, most of which are rough tracks. In many parts of the republic the camel and donkey are the only means of transportation. A radio-broadcasting system operates from Aden, and a commercial television station was established there in 1964. Three daily newspapers and several periodicals serve the country.

Government. Under the 1970 constitution, the People's Democratic Republic of Yemen is headed by a three-member presidential council. Legislative authority is vested in the 101-member Supreme People's Council, made up of representatives of the National Liberation Front (N.L.F.), the armed forces, and the labor movement. The judicial system includes a supreme court and magistrates' courts. The armed forces have about 9500 men.

History. Southern Yemen became an independent nation on Nov. 30, 1967. Its first president was Qahtan Muhammad al-Shaabi (1920-), the leader of the only political party, the N.L.F. The new republic faced serious political problems, particularly the conflict between the moderate and radical wings of the N.L.F., a rift that forced President Shaabi's resignation in 1969. The new regime, headed by Salem ali Rubayi (1934-78), took a more radical course. Many foreign-owned properties were nationalized, relations with the United States were severed because of the alleged anti-Arab policies of the U.S., and considerable aid was received from the Soviet Union. A long-range goal was the union of the two Yemens, but a 1971 agreement to that effect was not carried out because of political differences.

In June, 1978, President Rubayi was overthrown and executed after a bomb hidden in the briefcase of his personal envoy to Yemeni President Ahmed Hussein al-Ghashmi exploded, killing both men. Abdel Fattah Ismail then became president. While Rubayi was later exonerated, relations with Yemen remained extremely precarious. Yet, in March, 1979, the two countries concluded another provisional agreement on unification. The implementation, however, remained in doubt.

YENIMAHALLE, residential area of Turkey, forming the N.W. part of the greater city of Ankara, about 5 miles N.W. of the city center, with which it is connected by Istanbul Boulevard.

YENISEY or YENISEI, river of the Soviet Union, in Siberia, about 2543 mi. long. It is formed in the Sayan Mts. by the union of the Biy-Khem (Greater Yenisey) and the Ka-Khem (Little Ye-

nisey), in the E. part of the Tuviniian A.S.S.R., and flows generally N. The Yenisey flows swiftly through a deep gorge in the Sayan Mts. Less turbulent just S. of Krasnoyarsk, it traverses successively a grain-growing region, a region of coniferous forests (taiga), and the tundra. It empties into Yenisey Gulf, an arm of the Kara Sea; its estuary is 100 mi. long and has a maximum width of 40 mi. The Yenisey drains more than 1,000,000 sq.mi. Although navigable for about 1800 mi. it is usually frozen over from November to May. The chief tributaries of the Yenisey are the Kan, the Angara, the Kureyka, the Abakan, and the Upper, Stony, and Lower Tunguska rivers. The Ob'-Yenisey canal system joins the Yenisey to the Ob'R.

YEREVAN. See ERIVAN.

YERKES, Robert Mearns (1876–1956), American psychobiologist, born in Breadyville, Pa., and educated at Ursinus College and Harvard University. He taught at Harvard from 1902 to 1917 and at the University of Minnesota from 1917 to 1919. When the United States entered World War I he was placed in charge of psychological testing for the armed forces. Until 1924 he was chairman of the research information service of the National Research Council, and from 1924 to 1944 he was professor of psychology at Yale University. In 1929 Yerkes organized the Yerkes Laboratories of Primate Biology, Inc., at Orange Park, Fla. An authority on experimental animal psychology, he is noted particularly for his studies of the anthropoid apes. His writings include *The Mental Life of Monkeys and Apes* (1916), *The Mind of a Gorilla* (1927), and *Chimpanzees: A Laboratory Colony* (1943).

YERKES OBSERVATORY, astronomical observatory of the University of Chicago, located at Williams Bay, Wis. It was named for its donor, the American financier Charles Tyson Yerkes (1837–1905), and was dedicated in 1897. The principal instrument of the observatory is the largest refracting telescope in the world, having a 40-in. aperture. Newer telescopes of 40-in. and 24-in. aperture have recently replaced the original, smaller instruments and are supplementary to the now modernized 40-in. refractor. In order to provide the staff of the observatory with the use of a large reflecting telescope, an arrangement was made in 1932 with the University of Texas. The University of Chicago and the University of Texas operate jointly the McDonald Observatory in Fort Davis, Texas, with its 82-in. reflector, the seventh largest in the world.

YESHIVA UNIVERSITY, privately controlled institution of higher learning under Jewish auspices, located in New York City. The university

developed from the two oldest yeshivas, or Talmudic academies, in the United States, founded in 1886 and 1896, respectively, and merged in 1915. The institution attained university status and received its present name in 1945. Courses of study leading to the degrees of bachelor, master, and doctor are offered by the university. The Rabbi Isaac Elchanan Theological Seminary (1896), which trains students for the rabbinate, the undergraduate college of arts and sciences (1928), the Erna Michael College of Hebraic Studies, and the James Striar School of General Jewish Studies are for men; women are admitted to Stern College for Women (1954), to the teachers' institute for women (1952), and to the various graduate schools. Besides the foregoing, divisions of the university include the Bernard Revel Graduate School (1937) for advanced courses in Jewish and Semitic studies; the Belfer Graduate School of Science, which offers graduate programs in mathematics, chemistry, and physics and special lectures and courses for the layman; the Israeli Institute (1954), a part of the Bernard Revel Graduate School, which offers courses on the interrelationship between Israel and the American Jewish community; the Albert Einstein College of Medicine (1955), which is affiliated with the municipally owned Bronx Municipal Health Center; the Ferkauf Graduate School of Humanities and Social Science; the Wurzweiler School of Social Work; the cantorial training institute; and the Sue Golding Graduate Division of Medical Sciences. The university maintains the Yeshiva University High School, a four-year school, and a number of auxiliary services and facilities, including the community service division, the audio-visual service, and a psychological clinic. The latest addition to the university is the Albert Einstein College Hospital, which opened in January, 1966. In 1973 the university libraries contained some 568,000 bound volumes. In 1972–73 the total enrollment was 7000, the faculty numbered 2500, and the endowment was about \$3,600,000.

YEVTUSHENKO, Yevgeny Aleksandrovich (1933–), Soviet poet, born in Zima, Russian S.F.S.R., and educated at the Moscow Literary Institute. His first poem appeared in a Soviet sports journal. Shortly afterward his long epic poems began to be widely published in Soviet literary journals and magazines. His first collection of poetry received official Soviet praise. Yevtushenko was soon criticized for his themes of intellectual freedom, which were opposed by Communist functionaries demanding strict adherence to "social realism". Consequently, in 1956 his epic poem, *Zima Junction*, concerned



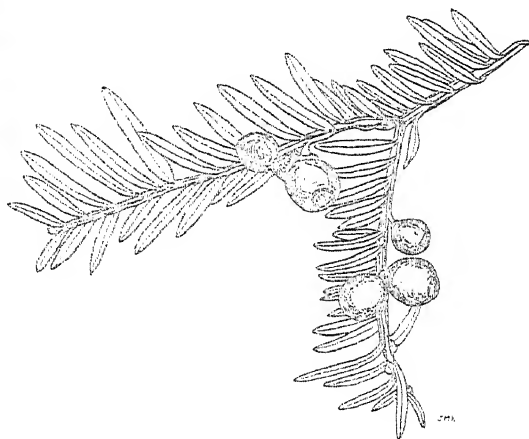
Yevgeny Yevtushenko gestures dramatically as he interprets some of his unpublished poems to an audience in Moscow. UPI

with the moral confusion of a young man in the post-Stalinist Soviet Union, was officially condemned. A similar reaction was received upon the publication in 1961 of *Babi Yar*, an impassioned attack against both National Socialism and Soviet anti-Semitism (q.v.). Yevtushenko has given readings of his poems before large audiences in the Soviet Union, western Europe, and the United States. Among his works translated into English are *Selected Poems* (1962), *A Precocious Autobiography* (1963), *The Bratsk Station and Other New Poems* (1967), and *Stolen Apples* (1971).

YEW, common name for the genus, *Taxus*, of evergreen, needle-bearing trees and shrubs, and, loosely, for other members of the Yew family, Taxaceae. Yews are native to temperate and subtropical climates throughout the world and are widely cultivated as ornamental plants, especially in foundation or accent plantings and hedges. The needle leaves are produced more or less in two ranks along the sides of the terminal branchlets. These leaves are dark green on the upper surface and yellower beneath; they persist through the winter. Flowers are inconspicuous; the fruit is an attractive scarlet-red berry. The wood is slow-growing, strong, and fine grained, and is utilized in cabinetmaking and for archery bows. The branches are often twisted or gnarled; the bark is red and scaly. Principal ornamental species include the English

yew, *T. baccata*, with several horticultural varieties, and the hardier Japanese yew, *T. cuspidata*, also with several horticultural varieties. The native North American yew of wooded hillsides and ravines is *T. canadensis*, also called ground hemlock. It is a straggly shrub, rarely more than 3 ft. tall. Western yew, *T. brevifolia*, is a tall tree native to the area from California to British Columbia and Alaska.

The foliage and seeds of yew contain highly poisonous alkaloids which often act to stop the heart of an animal so rapidly and suddenly that no symptoms are seen; the animal simply drops dead. The berries are attractive to children and



Japanese yew, *Taxus cuspidata*

their flesh is not distasteful. Fortunately, the flesh of the berries is the least poisonous part of the plant.

YIDDISH LANGUAGE, chief vernacular of Jews native to, or having antecedents in, eastern and central Europe. A German dialect (q.v.) written in Hebrew characters, it arose between the 9th and 12th centuries in southwestern Germany as an adaptation of Middle High German to the special needs of Jews; see GERMAN LANGUAGE; HEBREW LANGUAGE; SEMITIC LANGUAGES. To the original German were added those Hebrew words that pertained to Jewish religious life. Later, when the bulk of European Jewry moved eastward into areas occupied predominantly by Slavic-speaking peoples, there were some Slavic admixtures. The Yiddish spoken in eastern Europe during recent times comprised about 85 percent German, 10 percent Hebrew, and 5 percent Slavic, with traces of Rumanian, French, and other elements. Many English words and phrases entered Yiddish, becoming an integral part of the language as it is spoken in the United States and other English-speaking

countries. Apart from vocabulary changes, modern Yiddish differs from modern German mainly in the simplification of inflections and syntax and in its looser pronunciation of Germanic words; its derivation is similar to that of English, which too is a German dialect with a simplified grammar and a variously enriched vocabulary.

Yiddish exists in two groups of dialects. The northern group includes the Yiddish spoken in the Baltic countries and in the northwestern areas of the Soviet Union, and by Jewish emigrants or descendents from those areas. The southern group includes the dialects spoken in Poland, Rumania, and the Ukrainian S.S.R.

Yiddish is a highly plastic and assimilative language, rich in idioms, and possessing remarkable freshness, pithiness, and pungency. Since it was spoken by the common people rather than by scholars, its vocabulary is weak in abstractions. By the same token it has few terms descriptive of nature, with which the Jews of eastern Europe had relatively little contact, and a wealth of words and expressions descriptive of character and of relations among people. It makes liberal use of diminutives and terms of endearment and exhibits a variety of expletives. The use of proverbs and proverbial expressions is considerable. These qualities and usages give Yiddish a uniquely warm and personal flavor.

In the early years of the 20th century Yiddish was spoken by an estimated 11,000,000 people living mainly in eastern Europe and the U.S. The use of the language is declining at the present. The principal cause of the decline was the extermination of the Jewish communities in Poland and other eastern European countries during World War II. Another important factor is the adaptation by the Jews to the languages predominant in the U.S. and the Soviet Union. In Israel the Hebrew language is predominant and Yiddish is a second language, cultivated largely by members of the older generation who have an eastern European background; only a few of the modern Jewish poets write in Yiddish. In an effort to ensure its preservation, the Hebrew University (q.v.) in Jerusalem teaches Yiddish, as do certain American schools and colleges. The Yiddish Scientific Institute, founded in 1925 in New York City, devotes a large part of its activities to the study of the history and development of the Yiddish language.

See also YIDDISH LITERATURE.

N.N.G.

YIDDISH LITERATURE, writings by Jews in the Yiddish language (q.v.). Because Yiddish-speaking Jews are widely dispersed, Yiddish literature has been produced all over the world, but mainly in the countries of eastern Europe

and in the United States. In a formal sense, the literature remained unimpressive until modern times. Over the centuries, however, the Jews developed a vast heritage of tales, sayings, legends, songs, proverbs, and humor in which literature could take root.

The history of Yiddish literature falls into three periods, which could be designated as the period of preparation, the classical age, and the postclassical period.

The Period of Preparation. The oldest surviving writing in Yiddish is a single page of a work on folk medicine dated 1396. As long ago as the 12th century, however, Jewish minstrels wandered through Germany, entertaining their co-religionists by reciting Yiddish translations and adaptations of Gentile verse romances of the period. Although no Yiddish works of the 12th century survive, some idea of the character of these early romances can be gained from a later work of the same kind, the *Bovo Buch* (about 1507). This romance is a verse translation by the Jewish scholar Eliah Bahur (1469–1549), known also as Elijah Levita, of an Italian version, known as *Buovo d'Antona*, of the Bevis of Hampton tale, a popular romance of chivalry.

Aside from such romances, Yiddish literature before the 19th century consisted mainly of devotional works having little literary merit. Such works were designed to make the Jewish religion intelligible to the common people and particularly to the women, who, unlike the men, could rarely understand Hebrew. The best known of these writings is the *Tzeenah Ureena*, composed by Rabbi Jacob ben Isaac Ashkenazi (1534–72), at the end of the 16th century. A free reworking of stories from the Bible, according to Talmudic tradition, it was published in hundreds of editions. Other notable examples of devotional literature are the *Shmul Buch* ("Samuel Book", early 15th cent.), a retelling of the Biblical story of David; the *Maaseh Buch* ("Story Book", 16th cent.), a collection of moralistic tales that was enormously popular for centuries; and the various *Tehinnot*, devotional prayers for women.

The only noteworthy nondevotional works written before the 19th century were the memoirs of the German Jewish housewife Glueckel of Hameln (1646–1724), whose writings abound in perceptive descriptions of contemporary Jewish family life, and the diary of the first Swedish Jew, Aaron Isaac (1730–1817).

Yiddish literature came to flower under three main influences, namely Haskalah, Hasidism (see HASIDIM), and anti-Semitism (q.v.). Haskalah ("Enlightenment"), a movement to familiarize

YIDDISH LITERATURE

Jews with Western culture, was initiated in the 18th century by the German Jewish philosopher Moses Mendelssohn (see under MENDELSSOHN). The movement was greatly stimulated by the French Revolution, which led most European countries to grant citizenship to their Jewish inhabitants and disposed many of the enfranchised Jews to think of themselves primarily as nationals of the particular countries they inhabited. The leaders of the Haskalah despised Yiddish as a jargon and decried its use. They preferred Hebrew or the languages of their countries of citizenship. Nevertheless, to achieve their educational purpose, they were compelled to write in Yiddish, for it was the only language the masses of eastern European Jews understood. To educate these masses, the leaders of Haskalah published numerous Yiddish translations and adaptations of Western literary, historical, and scientific works, as well as original works of their own. Using Yiddish, some of the Haskalah literati learned to value the language they initially had despised. The most important of the Haskalah writers were the poet and dramatist Solomon Ettinger (1801?-55) and the novelist Isaac Meir Dick (1807-93).

Hasidism, a popular religious movement opposing the official Judaism (q.v.) of the learned rabbis, helped to give dignity to the Yiddish language and literature. To emphasize its popular character, Hasidism favored Yiddish, the language of the common people, over Hebrew, the language of the scholars. As the influence of Hasidism grew, Yiddish also rose in stature.

Anti-Semitism helped intensify the self-consciousness of the Jews and their appreciation of Jewish culture. As a result of such experiences as the series of Russian pogroms (see POGROM) launched in 1881, many Jews of Eastern Europe lost all hope of ever participating in general European culture. Believing there was no alternative but to return to the cultivation of their own heritage, these Jews began to create and read a literature of their own.

The Classical Age. The brief classical age of Yiddish literature, a period extending from late in the 19th century to the early part of the 20th, is epitomized in its three greatest figures, Shalom Jacob Abramowitz (1836-1917), better known as Mendele Mocher Seforim, or Seforim ("Mendele the Bookseller"), Shalom Aleichem (q.v.), and Isaac Leib Peretz (1851-1915). All three lived in the so-called Jewish Pale in the western part of the Russian Empire; all wrote about the everyday Jewish life of that region, and particularly about life in the shtetl, the Jewish village; and all were primarily writers of



Shalom Aleichem

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short stories and novelettes. Yet the work of each has its own unique character.

Mendele Mocher Seforim was the first to use Yiddish with artistic intent, that is, as a vehicle of literary creation, and not merely as a means of entertainment or instruction. In his stories he combined the sharpest satire with the deepest sorrow, a compassionate love for his people with a bitter rejection of the degradations of ghetto life and of the stultifying influence of the old Jewish traditions.

Shalom Aleichem, the most loved of all Yiddish writers, depicted with humor, sadness, and tenderness, the extraordinary characters that developed in the ghetto.

Isaac Leib Peretz is the most intellectual and the most self-consciously literary of the three writers. He had assimilated the influences of the great Russian authors of his time and of the classic literature of Western Europe, and his work is therefore more cosmopolitan than that of Mendele and Shalom Aleichem. His stories and novelettes have a psychological subtlety and penetration worthy of his Russian and Western European masters.

The work of all three of these writers arose out of a delicate balancing of folkish and literary influences. It is the product of that brief period in the life of the Jewish people when they first became fully aware of life outside their ghettos,

but before they had become inextricably involved in that outside life.

The Postclassical Period. After 1914 the traditional Jewish life of eastern Europe began to disintegrate under the impact of wars, migrations, revolutions, and persecutions. Many of the Yiddish writers who survived the succession of catastrophes that befell the Jews of eastern Europe fled to the U.S. and settled in New York City, which soon became a Yiddish literary center second only to Warsaw, Poland, in importance. Some migrated to the countries of Western Europe. Others went to Palestine. Others were affected greatly by the turmoil of Bolshe-



Isaac Leib Peretz

Zionist Archives and Library

vik Russia; see BOLSHEVISM. Among the most outstanding Yiddish authors of this period are Abraham Reisen (1876–1953), who wrote delicately evocative short stories; Sholem Asch (q.v.), who is well known to Gentile readers for his novels about the beginnings of Christianity; Israel Joshua Singer (1893–1944), who, along with Asch, helped to perfect the full-length Yiddish novel; Zalman Schneour (1887–1959) who was among the first to introduce erotic themes into Jewish writing; Moshe Kulbak (1896–1940) and David Bergelson (1884–1952), two of the leaders among the many Yiddish writers liquidated in the purges of the Soviet dictator Joseph Stalin (q.v.).

A group of gifted American Yiddish writers known as The Young Ones, including H. Leivick (1886–1962) and Joseph Opatoshu (1896–



Sholem Asch

UPI

1954), rebelled against the emphasis on social problems and the didacticism that characterized many of the Yiddish works of the classical period; these writers stressed individual creativity and pure art. Another group of poets and writers, including Jacob Glatstein (1896–1971) and Aaron Glanz (1889–1966), the latter writing under the name A. Leyeles, treated various cosmopolitan themes. The imaginative stories of the Polish-born American writer Isaac Bashevis

Isaac Bashevis Singer

Alfred Sundel – New American Library



YIDDISH LITERATURE

Singer (q.v.) portray themes of the lofty and the tragic, and of Jewish faith and its perversion. An excellent Yiddish literary quarterly, *Die Goldene Kait* ("The Golden Chain"), is published in Israel.

Poetry, Drama, Journalism. Although some of the earliest Yiddish writings were in verse, Yiddish poetry did not attain literary merit until the 20th century. Like the prose writers, all the leading poets originated in eastern Europe; most of them eventually migrated to the U.S. or to Palestine. The outstanding poets are Simon Samuel Frug (1860–1916), who wrote stirring songs expressing his yearning for Zion (q.v.); Morris Rosenfeld (1862–1923), who spent much of his life in the lower East Side of Manhattan in New York City and who composed impassioned protests against the sufferings of Jewish workers in slums and sweatshops; Chaim Nachman Bialik (q.v.), the greatest of modern Hebrew poets, who also wrote excellent verses in Yiddish; Yehoash, real name Solomon Bloomgarden (1871–1927), a leader of the New York group of Yiddish poets; and David Bergelson, the leading Yiddish poet and prose writer of the Soviet Union. Noteworthy Yiddish poets in the U.S. include Melech Ravitch (1893–), Aaron Zeitlin (1898–), Itzik Manger (1901–69), and Chaim Grade (1910–).

Yiddish drama, like other forms of Yiddish literature, began to have artistic distinction only toward the end of the 19th century. Before then, Jewish drama consisted mainly of *Purimspiel*, plays, largely improvised and based on stories from the Bible, that were performed on Purim (q.v.) and other Jewish holidays. The father of the modern Jewish theater is Abraham Goldfaden (1840–1908), who founded a Yiddish theater in Jassy, Rumania, in 1876. Other theaters were established soon thereafter in Odessa, Warsaw, Vilna, and other cities in the Jewish Pale of western Russia. After 1883, when the Russian government closed Yiddish theaters, most of the actors moved to New York City, which then became the most active center of the Yiddish stage. The first Yiddish plays produced in Europe and the U.S. were on a rather low cultural level. The works of three playwrights, however, raised considerably the level of the Yiddish stage. These men were Jacob Gordin (1853–1909); S. A. Ansky, real name Shloyme Zaynvi Rappaport (1863–1920), author of the world-famous *Dybbuk* (1920); and David Pinski (1872–1959). Dramatizations of novels by Asch, Israel Joshua Singer, and other writers, also made significant contributions. At their zenith, the Vilna Troupe, the Moscow Yiddish

State Theater, and the Yiddish Art Theater of New York were among the finest in the world.

Yiddish journalism figured significantly in the development of Yiddish literature. Because the demand for books was limited by the poverty of potential readers, most writers depended on newspapers both for livelihood and as outlets for their creative work. Leading writers published their stories, poems, and essays, serialized their novels, and conducted their controversies in the Yiddish press, which became very literary and educational in character.

The first successful Yiddish newspaper was the weekly *Kol Mevasser*, founded in Odessa in 1863 as a supplement to the Hebrew weekly *Ha-Melitz*. In 1865 the first Yiddish daily newspaper, *Yidishes Tageblatt*, was founded in New York. The *Jewish Daily Forward*, established in New York by the American editor and author Abraham Cahan (q.v.) in 1897, attained the largest circulation of any Jewish newspaper in the world.

Yiddish literature generally catches the special flavor of ghetto life, particularly its cruel deprivations, sordidness, narrowness, and insecurity; it reflects also the warmth and personal feeling of people who have little relationship with the land or with the larger world about them, and whose relationships are mainly with each other and with their God. Life in the New World, however, has gradually stimulated a new and more universal orientation in Yiddish literature. The catastrophe that befell European Jewry during World War II is reflected in many recent Yiddish literary works, some of which have considerable significance. The American critics Irving Howe and Eliezer Greenberg have co-edited recent anthologies of Yiddish stories (1954) and Yiddish poetry (1969). N.N.G.

YODEL, or JODEL, manner of singing by rapidly alternating between the chest voice and the head voice or falsetto. The yodel is wordless vocal improvisation that emphasizes the vowel sounds. Many musicologists believe that the yodel was devised by shepherds in imitation of various horned instruments used in calling their herds and flocks. The yodel is most closely identified with the inhabitants of the Swiss and Tyrolean Alps, although it may not have originated with them.

YOGA (Skr. *yuga*, "yoke"), one of the six classic systems of Hindu philosophy, distinguished from the others by the marvels of bodily control and the magical powers ascribed to its advanced devotees; see HINDUISM. Yoga affirms the doctrine that through the practice of certain disciplines one may achieve liberation from the

limitations of flesh, the delusions of sense, and the pitfalls of thought and thus attain union with the object of knowledge. Such union, according to the doctrine, is the only true way of knowing. For most Yogi (those who practice Yoga), the object of knowledge is the universal spirit Brahma (q.v.). A minority of atheistic Yogi, however, seek perfect self-knowledge instead of knowledge of God. In any case, it is knowledge and not, as is commonly supposed, feats of asceticism, clairvoyance, or thaumaturgy, that is the ideal goal of all Yoga practices. Indeed, Yoga doctrine does not approve of painful asceticism; it insists that physical and mental training is not an end in itself, and that it is not to be used for display but only as a means to spiritual ends. Man, according to Yoga doctrine, must work out his own salvation.

The Eight Stages. Yoga practice forms a ladder leading to perfect knowledge. (1) Self-control (*yama*) involves truthfulness, abstinence, avoidance of theft, refusal of gifts, and not doing injury to living things. (2) Religious observance (*niyama*) embraces austerity, poverty, contentment, purification rites, recital of the Vedic hymns, and devoted reliance on the Supreme Being. (3) Postures (*āsana*), of which there are a great many, are regarded as basic to all the stages that follow. (4) Regulation of the breath (*prāṇāyāma*) includes altering its depth and rhythm, breathing through either nostril at will, and the virtual suspension of breath. (5) Restraint of the senses (*pratyāhāra*) means their withdrawal from external objects and the consequent turning of the mind upon itself. (6) Steadying of the mind (*dhārāṇa*) narrows attention to some one part of the body, like the navel, the tip of the nose, or the middle of the brow, and in that way renders the practitioner insensitive to outside disturbance. (7) Meditation (*dhyaṇa*) fixes the mind on the object of knowledge, especially Brahma, to the exclusion of all other thoughts. (8) Profound contemplation (*samādhi*) is the perfect absorption of thought in the object of knowledge, its union and identification with that object. The achievement of *samādhi* liberates the self from the illusions of sense and the contradictions of reason. It is thought that has gone beyond thought, reaching its goal by its own negation. It leads to an inner illumination, the ecstasy of the true knowledge of reality.

Liberation. The final stage, in Yoga doctrine, rarely can be attained in one lifetime. Usually, several births are required to achieve liberation, first from the world of phenomena, then from thoughts of self, and finally from the spirit's en-



The Yoga handstand, one of many Yoga postures that help to develop bodily control. UPI

tanglement with matter. The separation of spirit from matter is *Kāivalya* or true liberation. See TRANSMIGRATION.

As the adept approaches *Kāivalya*, he is supposed to acquire certain remarkable capacities. He becomes insensible to heat or cold, to injury, to pleasure or pain. He can perform supernatural mental and physical feats and even change the course of nature. He can distinguish the subtlest elements of matter and can, at the same time, see the universe as a whole, comprehending both microcosm and macrocosm in the same thought.

Such are the powers claimed or promised by

YOGA

Yoga. Few, if any, of these powers have been successfully demonstrated to disinterested observers. Nevertheless, extraordinary achievements have been reported by sober witnesses. Most impressive, perhaps, is the Yogi-sleep, in which animation is nearly suspended, enabling the Yogi to be buried alive for days. The Yogi-sleep has been explained by some authorities as a sort of cataleptic state induced by self-hypnosis and not essentially different from the cataleptic states that can be seen in mental hospitals.

Various Systems of Yoga. The aspirant has a selection of practices to suit his capability and environment. Many of the wonder-working Yogi and almost all Occidental devotees are practitioners of Hatha (physical) Yoga. The latter is the basic system because it is concerned with developing those bodily controls from which all else follows. The other systems differ mainly in the varying emphases placed on the several phases of Yoga practice. Perhaps the most popular system in India is Bhakti (devotional) Yoga. This system gives primary emphasis to the first two stages of Yoga discipline, that is, self-control and religious observance. Other important Yogas are Mantra Yoga, which devotes itself to uttering the name of Krishna (q.v.) and other incantations; Karma Yoga, the path of work and service; and Jnana Yoga, the way of intellect. The synthesis of Bhakti, Karma, and Jnana Yogas is called Raya (royal) Yoga.

History. The doctrines and practices of Yoga date to the period of the Upanishads (q.v.). The Maitrī Upanishad in particular outlines the essential practices of Yoga. These practices were elaborated and given a philosophical foundation in the *Yoga Sūtra* of the Indian scholar Patañjali (fl. 2nd cent. B.C.), who is traditionally regarded as the founder of Yoga. Patañjali derived his doctrine from Sāmkhya, the oldest of the classic systems of Hindu philosophy. In order to explain evolutions, he departed from the system by grafting the concept of God (Īśvara) upon the atheistic outlook of Sāmkhya. The concept is not an integral part of Yoga doctrine; indeed, some authorities consider it to be actually in contradiction with the rest of the system. In any case, Yoga, unlike other systems of Hindu philosophy, has subordinated doctrine to the refinement of practice. Systematic study of Yoga doctrine has declined in recent centuries.

As a system of practice, Yoga has from the beginning been one of the most influential features of Hinduism. The influence of Yoga can be seen especially in Buddhism, which is notable for its austerities, spiritual exercises, and trance

states. Yoga exerted a powerful attraction upon the Indian mind because of the wonders attributed to it and because it gives countenance to the performance of austerities, to which Hindus are so strongly inclined. As knowledge of Yoga spread, it fascinated many Westerners and won followers among them. Among more recent students of Yoga are the British writers Major Francis Yeats-Brown (1886–1944), Aldous Leonard Huxley (see *under* HUXLEY), and Christopher Isherwood (1904–), the Rumanian-born writer on religion Mircea Eliade (1907–), and the American violinist Yehudi Menuhin (q.v.). Yoga is an important ingredient in Theosophy (q.v.) and other occult movements that are currently in vogue in the West. In recent years, it has been seized upon by certain health cultists, who recommend the Yoga exercises as a means of cleansing the body of impurities, of reducing weight, of toning up the nerves and muscles, and, generally, of improving health and prolonging life.

See RELIGION: *The Ways of Liberation*.

YOGURT or YOGHURT, fermented, semifluid milk product, used extensively as a health food. It is prepared from fresh whole or skim milk, boiled and concentrated by evaporation. Fermentation (q.v.) is caused by the addition of cultures of two bacteria, *Lactobacillus acidophilus* and *Streptococcus thermophilus*. New batches of yogurt can be produced by introducing into concentrated milk a portion of a previously prepared batch. This type of fermented milk has long been an important constituent of the diet in southeastern Europe and in Asia Minor. In recent years yogurt has become increasingly popular in the United States.

YOKKAICHI, city and port of Japan, in Mie Prefecture, on Honshu Island, on the N.W. shore of Ise Bay, about 25 miles S.W. of Nagoya. It is an important commercial and manufacturing center. Among the chief manufactures are cotton goods, a porcelain product called banko ware, cement, plate glass, processed tea, paper, and silk; the first three products are also the chief exports. Raw cotton and wool are the chief imports. Pop. (1970) 229,234.

YOKOHAMA, city and port in Japan, and capital of Kanagawa Prefecture, on Honshu Island, on Tokyo Bay, about 20 miles S. of Tokyo. It has excellent harbor facilities and is one of the leading ports of Japan. The city leads Japan in the export of silk. An important industrial center, Yokohama has shipyards, oil refineries, and plants engaged in the manufacture of chemicals, electrical equipment, processed food products, and machinery. In the city are numerous



The multipurpose tower dominating Yokohama harbor serves as a lighthouse, a museum, and a restaurant.

shrines, temples, and Christian churches, and a number of beautiful parks.

History. A small fishing village, Yokohama had a population of about 350 in 1854, the year it was visited by the United States naval squadron under Commodore Matthew Calbraith Perry (see under PERRY). The port began to flourish as a commercial center in 1859, when it was opened to foreign commerce. Extraterritorial privileges were extended to foreigners, and the foreign settlement became the nucleus of the city. Yokohama was almost totally destroyed in 1923 by an earthquake. Gradually reconstructed according to government designs and specifications, the city now ranks among the most modern in Japan. It was heavily bombed in 1945, during the course of World War II (q.v.). Pop. (1970) 2,238,264.

YOKOSUKA, city and port of Japan, in Kanagawa Prefecture, on Honshu Island, on Tokyo Bay, 31 miles s. of Tokyo. Yokosuka has a large, sheltered harbor. In the city, which is headquarters for a fleet of whaling ships, are automobile-assembly plants and shipyards. The development of Yokosuka dates from 1865, when a shipyard was established there. The port is the site of a former important Japanese naval base. Pop. (1970) 347,576.

YOM KIPPUR (Heb. *yom hakippurim*, "day of atonement"), in Judaism, holiday falling on the

tenth day of Tishri, the seventh month of the Jewish ecclesiastical year and the first of the civil year, occurring in September or the first half of October. It climaxes the observance of the Ten Penitential Days, which begin with Rosh Hashanah (q.v.), or the New Year, and is the most sacred of Jewish holidays; with Rosh Hashanah it comprises the so-called High Holy Days. Yom Kippur is a day of confession, repentance, and prayers for forgiveness of sins (see SIN) committed during the year against the laws and covenant (q.v.) of God (q.v.). It is also the day on which an individual's fate for the ensuing year is thought to be sealed. The laws relating to it are found in Lev. 16, 23:26-32, 25:9, and Num. 29:7-11. In the days of the Temple at Jerusalem (see TEMPLE: *Temple at Jerusalem*) the high priest (q.v.) offered sacrifices (see SACRIFICE) for the expiation of sin. At one point during the ritual the high priest placed his hands upon a goat as he confessed the people's sins; the goat was then taken into the wilderness and thrown down a precipice. This act symbolized expiation and God's forgiveness. The concept of the "scapegoat", something or someone that takes the blame for others, originated in this ceremony.

Today Jews observe the day by a rigorous fast

YONKERS

and nearly unbroken prayer. The mood is solemn but not mournful, as evidenced by the Oriental Jewish custom of calling Yom Kippur the "White Fast"; this is in contradistinction to Tishah b'Av (the ninth day of the month of Av), the "Black Fast", which commemorates the destruction of the Temple. See also PRAYER, JEWISH.

S.L.

YONKERS, city of New York, in Westchester Co., on the Hudson R., bordering the borough of the Bronx, New York City on the s. The city is served by railroad and a municipal airport is nearby. A residential and manufacturing center, the chief industries include printing and publishing and the production of apparel, chemicals, fabricated metals, foodstuffs, machinery, and transportation equipment.

Among major points of interest in Yonkers are several museums of regional history, including the Philipse Manor Hall (1682); and the Cross County Center, one of the largest suburban shopping centers in the United States. The city is the site also of Saint Joseph's Seminary, a training school for the Roman Catholic priesthood, and The Boyce-Thompson Institute for plant research.

Originally occupied by an Indian village, the site of Yonkers was purchased (1639) by the Dutch West India Company (q.v.) and formed part of a land grant made in 1646 to the Dutch colonizer Adriaen Van der Bonck (1620–55?). The courtesy title he enjoyed there was *jonker* ("young lordship"), thus the name of the present-day city. After 1672 the settlement became a part of the large tract of land acquired by the Philipse family. The Manor of Philipsburgh was confiscated (1779) by colonial forces during the American Revolution (q.v.) because of the family's royalist sympathies. Yonkers was incorporated as a village in 1855 and as a city in 1872. Pop. (1960) 190,634; (1970) 204,370.

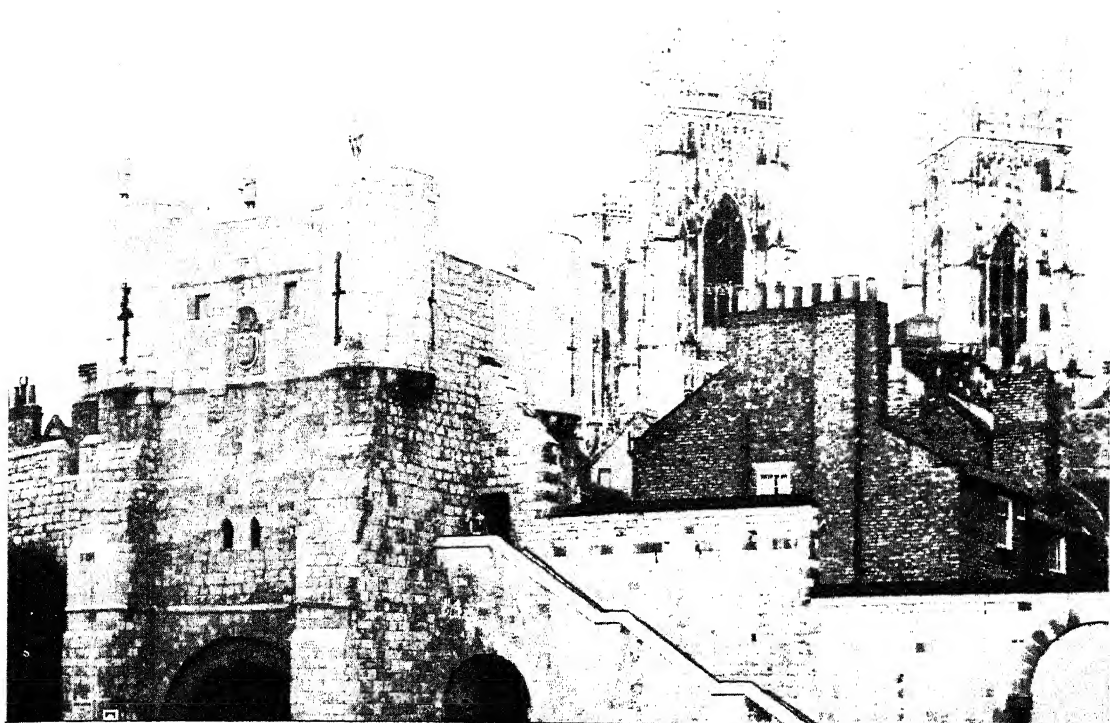
YORK, city in Pennsylvania, and county seat of York Co., about 25 miles s.e. of Harrisburg. The industrial center of a rich agricultural region, York has plants producing caskets, chains and cables, chemicals, clothing, electronic equipment, furniture, heating equipment, office equipment, refrigeration machinery, and water turbines. It is the seat of York Junior College. Points of interest include Penn Common, the Friends' Meetinghouse (1765), and Continental Square, site of the colonial courthouse (1756).

Settled in 1735, York is the oldest settlement in the State west of the Susquehanna R. In 1777–78, during the American Revolution (q.v.), York served as the Federal capital; see CAPITALS OF THE UNITED STATES. It was the headquarters of

the Continental Congress, which there passed the Articles of Confederation (qq.v.). York was incorporated as a borough in 1787. In 1863, before the Battle of Gettysburg in the American Civil War, it was occupied by Confederate troops under General Jubal Early (q.v.). York was chartered as a city in 1887. Pop. (1960) 54,504; (1970) 50,335.

YORK (anc. *Eboracum* or *Eburacum*), Great Britain, county borough of West Riding, Yorkshire, England, at the junction of the Ouse and Foss rivers, 60 miles n.e. of Manchester. An industrial and commercial center, York has plants producing chemicals, chocolate, leather goods, railroad equipment, and scientific instruments. York is the site of numerous architectural landmarks, of which the most important is York Cathedral, popularly known as York Minster. The cathedral, erected on the site of a 7th-century church was built chiefly between the 12th and 14th centuries; the towers date from the 15th century. The cathedral is a magnificent example of Gothic architecture (q.v.), and contains more medieval glass than any other church in England. Particularly noteworthy is the north transept, with its beautiful windows, the choir and the Lady chapel, the wooden vaulting of the nave, and the octagonal chapter house. York also has several other churches of architectural interest. The city walls, containing four main gates, or bars, date chiefly from the 14th century. Within the walls is the oldest section of the city, an area noted for its narrow, crooked streets and medieval appearance. Other landmarks include the Multangular tower, a Roman relic; remains of Clifford's Tower (13th century), near the site of a castle built (1068) by William I (q.v.), called William the Conqueror; Merchant Adventurers' Hall (1387); ruins of the guildhall (1446–48); and Saint William's College (1453), now a church house.

History. The Brigantes, a Celtic tribe, settled on the site of present-day York in early times. In the 1st century A.D. the settlement was occupied by the Romans who named it *Eboracum* and made it the military capital of their British possessions. The Roman emperors Lucius Septimius Severus and Constantius I (qq.v.) died in *Eboracum* and Constantine I (q.v.), called the Great, was proclaimed emperor there. The town was made the capital of the Anglian kingdom of Northumbria (q.v.) in the 7th century and about 625 it became an archiepiscopal see. The archbishop of York ranks second only to the archbishop of Canterbury in the hierarchy of the Church of England (q.v.). In the 8th century York was renowned as a center of learning. It was a



York Minster, an imposing English landmark.

British Travel Assn.

kingdom under the Danes and was later a vassal state of the West Saxons. York was burned by William the Conqueror. It received its first charter from King Henry II (q.v.). During medieval times the city was a commercial center and Parliament (q.v.) occasionally met there. It was noted also for its cycle of miracle plays (q.v.). In 1537 King Henry VIII (q.v.) established the Council of the North in York to deal with the situation created by the insurrectionary Pilgrimage of Grace after the dissolution of the monasteries. York surrendered to the Parliamentarians in 1644 following the Battle of Marston Moor. York was severely bombed during World War II (q.v.). Pop. (1971) 107,150.

YORK, 3rd Duke of, Richard Plantagenet. See YORK, HOUSE OF.

YORK, Alvin C. (1887–1964), American soldier, born in Pall Mall, Tenn. He enlisted in the United States Army in 1917, during World War I, and became a sergeant in the 328th Infantry, 82nd Division. In an action in the Argonne Forest on Oct. 8, 1918, York singlehandedly captured a German machine-gun battalion occupying a fortified hill; see ARGONNE, BATTLE OF THE. He killed 25 enemy soldiers and took 132 prisoners. Acclaimed as one of the outstanding heroes of the war, he was awarded the Congressional Medal of Honor and the French Croix de Guerre. Public donations enabled York to purchase a farm in Tennessee and to establish the York Foundation for the education of children living in the mountains of his home State.

YORK, HOUSE OF, English royal line that in the latter half of the 15th century disputed the throne of England with the House of Lancaster (q.v.). Both York and Lancaster were branches of the royal House of Plantagenet (q.v.). Their dynastic rivalry developed into the Wars of the Roses, so named because the Yorkist and Lancastrian emblems were the white and red rose, respectively; see ROSES, WARS OF THE.

The title "Duke of York" was created in 1385 for Edmund of Langley (1341–1402), fifth son of King Edward III (q.v.). Edmund's grandson, Richard Plantagenet, 3rd Duke of York (1411–60), laid claim to the throne then occupied by King Henry VI (q.v.), who was descended from the fourth son of Edward III and was head of the House of Lancaster. Richard claimed a prior right to it through his maternal grandfather, Roger VI de Mortimer, 4th Earl of March and Ulster (1374–98), whose son had been recognized as heir presumptive by King Richard II (q.v.). Richard's claim was considered just by Parliament, and it was agreed that the House of York should inherit the throne on Henry's death. Henry VI consented to this proposed arrangement.

Henry's queen, Margaret of Anjou (q.v.), however, wanted her son, Edward, Prince of Wales (1453–71), to succeed his father, and in 1455 she raised an army to defend his claim, thus beginning the Wars of the Roses. Richard was killed

YORKSHIRE

in battle at Wakefield in 1460, but in 1461 his eldest son was proclaimed Edward IV (q.v.), King of England, the first of the Yorkist line of English kings.

On the death of Edward IV in 1483, his eldest son, a boy of twelve, became king as Edward V (q.v.). The young king was promptly imprisoned with his younger brother in the Tower of London (q.v.) by his paternal uncle, Richard Plantagenet, Duke of Gloucester, who was crowned King Richard III (q.v.) on June 26, 1483. Edward V and his brother were murdered; according to traditional belief, Richard was responsible for the death of the two boys, but modern scholarship has given rise to a controversy that leaves the question of his guilt in doubt. In 1485 Richard III was killed in the Battle of Bosworth Field, the last action of the Wars of the Roses; see **BOSWORTH FIELD, BATTLE OF**. With his death, the York dynasty came to an end.

The victor at Bosworth Field was Henry Tudor, Earl of Richmond, who was descended through his mother from the House of Lancaster. He ascended the throne as King Henry VII (q.v.), and was the first English king of the House of Tudor (q.v.). He strengthened his right to the throne by marrying Elizabeth (1465–1503), the daughter of the Yorkist king Edward IV.

After 1485 descendants of Edward IV's sister Elizabeth and brother George, Duke of Clarence (see *under* **CLARENCE**), pressed claims to the throne. The last serious pretender of the House of York was Elizabeth's son Richard de la Pole (d. 1525).

YORKSHIRE, Great Britain, maritime county of n.e. England and largest of the United Kingdom. York is bordered on the n. by Westmorland and Durham, on the e. by the North Sea, on the s. by Lincolnshire-Lindsey, Nottinghamshire, and

Derbyshire, and on the w. by Cheshire and Lancashire. It is divided into three jurisdictions known as East Riding, West Riding, and North Riding, that, for administrative purposes, form separate counties. The surface of Yorkshire is diversified, the Pennine Chain (q.v.) occupying the w. part, with lower groups of hills in the e. The central portion forms the valley of the Ouse, which enters the Humber estuary on the s. boundary. Other rivers of the county include the Aire, Derwent, Swale, and Wharfe. In East Riding, chiefly an agricultural region, is the city of Hull (q.v.), a leading seaport of Great Britain. North Riding, also agricultural, contains the manufacturing city of Teesside. West Riding is a leading manufacturing district; of chief importance is the textile industry, centered in Leeds and the steel industry in Sheffield (qq.v.). The county is rich in coal (West Riding) and iron (North Riding), and basalt and limestone are quarried. A number of popular resorts are located along the coast. Other important cities are York (q.v.) and the administrative centers of Beverly in East Riding, Northallerton in North Riding, and Wakefield (q.v.) in West Riding.

Prior to the Roman conquest the region comprising present-day Yorkshire was inhabited by the Brigantes, a powerful Brythonic tribe (see **CELTIC PEOPLES AND LANGUAGES**). The region formed part of the Anglo-Saxon kingdom of Northumbria (q.v.) in later times. In the 9th century it was largely settled by Danish invaders. Much of the county was laid waste during the Norman Conquest. Yorkshire is rich in architectural landmarks, including cathedrals and ruined castles and abbeys. Area, 6089 sq.mi.; pop. (1971) 7,469,600.

YORKSHIRE TERRIER, type of toy terrier (q.v.) bred in Lancashire and Yorkshire, England, from

Yorkshire terrier UPI



a number of other terriers, principally the Skye and the Manchester terriers; it was first exhibited at a dog show in 1861, in England, and the first definite use of its present name was in 1886. The dog was a favorite as a pet of the English aristocracy in the last quarter of the 19th century; it was first imported into the United States in 1880. It has a small, flat head; small, V-shaped ears; medium-sized dark eyes; a compact body; and straight legs that are covered with hair that is tan or golden tan in color. The Yorkshire terrier has a coat of moderately long, glossy hair of silky texture. In color the animal is a dark steel blue from the back of the skull to the root of the tail; the head is a golden tan; and the chest is a bright tan. The Yorkshire terrier weighs from 4 to 12 lb.

YORKTOWN, SIEGE OF, in American history, name applied to military engagements fought at Yorktown, Va., one at the end of the American Revolution and the other during the American Civil War.

Siege of Yorktown (1781), final major action of the American Revolution (q.v.), concluded by the surrender of British troops on Oct. 19, 1781. During the action American and French land forces under General George Washington, collaborating with a French fleet commanded by Admiral Comte de Grasse, surrounded the British under Charles Cornwallis, 1st Marquis Cornwallis (qq.v.), second in command of the British forces in North America. The siege lasted twenty days. The surrender of Cornwallis resulted in the resignation of the British prime minister, Frederick North (q.v.), 2nd Earl of Guilford, and brought to power more conciliatory leaders. The latter accepted the terms of the Treaty of Paris, signed on Sept. 3, 1783, which officially ended the war; see PARIS, TREATY OF.

Prior to the action at Yorktown, Cornwallis had moved north from North Carolina in an unsuccessful effort to draw the pursuit of American forces led by General Nathanael Greene (q.v.). In Virginia the British advanced against militia under the French commander the Marquis de Lafayette (q.v.), but Cornwallis would not enter the interior regions and subsequently withdrew to Williamsburg, where he received orders to establish defensive positions on Chesapeake Bay. The British fortified Yorktown and the town of Gloucester, on the opposite side of the York R. Lafayette and a small force of Americans, who had followed Cornwallis to Yorktown, notified Washington, encamped in West Point, N.Y., of the British position and preparations.

Soon after receiving the news Washington

decided to launch a surprise attack on Cornwallis. Leaving some 3000 troops behind to defend the forts along the Hudson R. and to mislead the British command in New York City about his main objective, Washington set out for Virginia about the middle of August. His force numbered about 7000 men, including French regular troops under the Comte de Rochambeau (q.v.). They arrived at Williamsburg on Sept. 14, 1781. Meanwhile a French fleet under de Grasse had succeeded in blockading Chesapeake Bay, thus preventing a possible British escape. In addition, about 3000 French troops had landed from Grasse's ships and joined Washington's army.

The American and French troops reached Yorktown on Sept. 26. Some 15,000 strong, they laid siege to the British positions. American assault forces captured two British strongholds on the night of Oct. 14, and a British counterattack proved ineffective. Recognizing the hopelessness of his position, Cornwallis requested a truce on Oct. 17 and signed articles of surrender two days later. A British reinforcement of 7000 troops under Sir Henry Clinton (q.v.) turned back to New York after receiving news of the surrender on Oct. 24.

Washington achieved the victory at Yorktown by coordinating his widely scattered land and sea forces, and his effort is generally considered one of the most skillful military operations in history. Although peace was not officially proclaimed until 1783, hostilities virtually ceased after the siege.

Siege of Yorktown (1862), engagement of the American Civil War. On April 5, 1862, the Union Army of the Potomac, commanded by General George Brinton McClellan (q.v.), surrounded Yorktown, which was held by Confederate forces under General Joseph Eggleston Johnston (q.v.). The siege continued until May 3, when Johnston withdrew in the direction of Richmond before McClellan could make use of newly arrived artillery. See CIVIL WAR, THE AMERICAN.

YORUBA, Sudanic-speaking African people inhabiting southwest Nigeria. The Yoruba are predominantly town dwellers who practice hoe agriculture and are well known as traders and craftsmen. Yoruba artists have produced masterpieces of woodcarving and bronze casting, some of which date from as early as the 13th century; see AFRICAN ART. The Yoruba religion is animistic, and numerous gods are worshiped.

The early history of the Yoruba is obscure. By the 17th century their leaders had succeeded in establishing a strong and flourishing state, the kingdom of Oyo, in the region between Daho-



Wooden mask, carved by a contemporary artist of the Yoruba people. Museum of Primitive Art

me and the Niger R. Oyo disintegrated into numerous petty kingdoms during the first half of the 19th century. Toward the end of the 19th century the Yoruba came under British control. They now comprise about 16 percent of the population of Nigeria, living chiefly in the city of Ibadan (q.v.).

YOSEMITE NATIONAL PARK, area of natural interest in central California, about 150 miles e. of San Francisco. The park covers an area of 761,320.32 acres. The irregular e. boundary follows the crest of the Sierra Nevada, from the w. watershed of which are derived the headwaters of the Tuolumne and Merced rivers. The Tuolumne R. passes through the Hetch Hetchy Valley, becoming the water-supply source for San Francisco; the Merced enters the famous Yosemite Valley, a narrow gorge about 7 mi. long and about 1 mi. wide, formed by the action of the river and by glacial erosion during the Ice Age.

Scenic Phenomena. The Yosemite Valley is celebrated for some of the most spectacular scenery in the world: beautiful rock formations, gigantic waterfalls, striking heights, and lovely meadows and forested areas. Great precipices of granite rise sharply from the valley floor, which is about 4000 ft. above sea level. Among these towering cliffs are Clouds Rest (9926 ft.),

Half Dome (8842 ft.), Eagle Peak (7773 ft.), and El Capitan (7569 ft.).

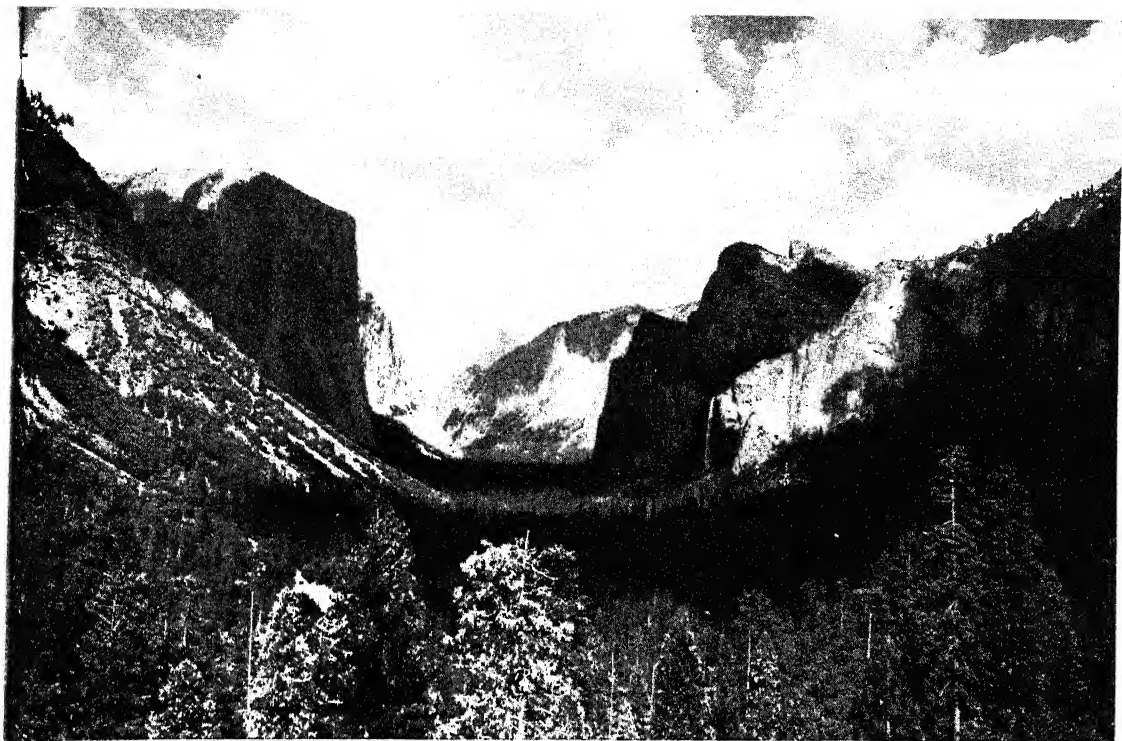
The waterfalls in the valley include a magnificent group of cataracts. Yosemite Falls (2425 ft.) consists of Upper Yosemite Fall with a drop of 1430 ft., a series of leaping cascades falling another 675 ft., and finally Lower Yosemite Fall with a drop of 320 ft. Other celebrated cataracts are Ribbon Fall, with an uninterrupted drop of 1612 ft.; Bridalveil Fall (620 ft.), which ends in a delicate misty spray; and Vernal Fall (317 ft.), noted for the rainbow hues in its sparkling waters. The falls are seen to best advantage in May and June; by mid-August many of them may be dry because of insufficient rain or snow.

The park has numerous other attractions in addition to Yosemite Valley. Some of the great peaks of the Sierra Nevada are situated on the e. boundary; the highest peak is Mt. Lyell (13,114 ft.). Glacier Point, 3254 ft. above the valley floor, commands the most breathtaking view of the valley and of the High Sierras. The Grand Canyon of the Tuolumne contains many waterfalls, of which the most famous is Waterwheel Falls, so called because of the great arcs of water thrown high into the air by the projecting rocks of the river bottom. The Tuolumne Meadows area near the upper end of the river is noted as a camping site.

Plant and Animal Life. The Mariposa, Tuolumne, and Merced groves of giant sequoia (q.v.) trees are of great interest; one, the Grizzly Giant in the Mariposa Grove, is believed to be about 3800 years old; it has a maximum base diameter of 34.7 ft., and is 209 ft. tall. An automobile road passed through an opening in the Wawona Tree in the Mariposa Grove until the tree was felled by heavy snow in 1969. Plant and animal life of the park includes about 60 species of mammals, of which bear and deer are most common; 200 species of birds; 1300 varieties of flowering plants; and 31 species of trees.

Activities. The main park museum, at Government Center in Yosemite Valley, has exhibits of geology, plant and animal life, and of Indian culture of the region. The park has about 700 mi. of hiking and riding trails, and lodges, camps, and hotels are provided for tourists. The park is open all year, with facilities for winter sports, notably at Badger Pass.

History. White men probably saw Yosemite Valley as early as 1833, but it was not generally known until 1851, when a band of militia, known as the Mariposa battalion, entered the area. In 1864 the valley and the Mariposa Grove of Big Trees were set aside by act of Congress to be administered as a public trust by the State of



California. In 1890 the Yosemite National Park, including the valley and adjacent high-mountain country, was established by act of Congress, and in 1906 Yosemite Valley and the Mariposa Grove were ceded to the Federal government by the State. The park is administered by the National Park Service (q.v.).

YŎSU, city and port of South Korea, in South Chŏlla Province, on a bay of the Korea Strait, 75 miles s.w. of Pusan. At the tip of a peninsula, it is a rail-spur terminus and exports fish, rice, silk, and seaweed. Industries include rice refining, boatbuilding, silk processing, fish packing, and the manufacture of rubber products. Also known as Yeosu, the city was called Reisui by the Japanese. Pop. (1970) 113,651.

YOUMANS, Vincent (1898–1946), American composer of popular music, born in New York City. He enlisted in the Navy during World War I and served at the Great Lakes Naval Training Station in Illinois, where he wrote and produced musical entertainment for the servicemen. His first popular song success was "Oh Me! Oh My! Oh You!" featured in his musical *Two Little Girls in Blue* (1921). The score of his famed musical comedy *No, No, Nanette* (1925) contained the still popular hit songs "Tea for Two" and "I Want to Be Happy". During the next decade Youmans wrote other successful shows, notably *Hit the Deck* (1927), *Great Day* (1929), and *Take a Chance* (1932). In 1933 he wrote the score for

View of the Yosemite Valley, with the cliffs of El Capitan on the left, Clouds Rest and Half Dome in the distance, and Bridalveil Fall in front of Cathedral Rocks at the right.

Ralph H. Anderson - National Park Service

the motion picture *Flying Down to Rio*. His other well-known songs include "Without A Song", "Sometimes I'm happy", "Halleluja", and "Time on My Hands".

YOUNG, Brigham (1801–77), leader of the Church of Jesus Christ of Latter-day Saints, frequently referred to as Mormons (q.v.), and colonizer of Utah (q.v.), born in Whitingham, Vt. He spent his boyhood in the farm country of Vermont and western New York and received only two months of formal schooling. Subsequently he worked as a carpenter, glazier, and journeyman painter. In 1829 he settled in the town of Mendon, N.Y. There he met a brother and disciple of Joseph Smith (q.v.), founder and prophet of the Mormons. Smith's brother converted Young, previously a Methodist (see METHODISM), to Mormonism, and on April 14, 1832, he was baptized and confirmed in the church. Young quickly distinguished himself as a preacher and evangelist in the area around Mendon; within the year he was ordained an elder (q.v.).

Between 1833 and 1836 his fame and stature within the Mormon movement rapidly increased. About 1833 he organized a group of Mormons in the eastern States and led them to Kirtland, Ohio, where Joseph Smith had estab-

lished headquarters. At Kirtland, Young met Smith for the first time. Impressed by Young's zeal and persuasive powers, Smith sent him into the surrounding States and Canada on a variety of missionary assignments. When, in 1835, the Mormons created a Quorum, or Council, of Twelve Apostles with powers second only to those of Smith, Young was named one of the apostles. In 1836 he was elected president of the Quorum. He was a strong figure in the movement during the period of persecution climaxed (1838) by the migration to Hancock County, Ill., and the establishment there of Nauvoo as the new center of Mormonism.

From 1839 to 1841 Young worked with the Mormon mission in Liverpool, England, preaching and distributing religious literature; he arranged for the emigration of about 70,000 converts from Europe to America. He returned to the United States in 1841 and for several years served as a missionary in the eastern States. After the shooting of Joseph Smith by a lynch mob in 1844, Young was elected acting president of the Mormon Church and henceforth was its leader.

As a result of sentiment against their group in Illinois, Young and his colleagues decided to leave Nauvoo. In 1846–47 he organized and supervised the migration of almost 5000 Mormons across the Great Plains and the Rocky Mts. into the arid Great Basin. There, in Great Salt Lake Valley, he founded in July, 1847 Great Salt Lake

City. On Dec. 5, 1847, he was formally elected head of the Mormon Church.

Under Young's autocratic leadership Salt Lake City and the surrounding region soon became the Zion (q.v.), or promised land, that the Mormons had long sought. His followers built extensive irrigation projects; developed farms, small businesses, and cooperative stores; and set up a legislature, public school, and two institutions of higher learning. In 1850 the Congress of the United States enacted legislation establishing the region, previously known as the State of Deseret, as the Territory of Utah. Young was made territorial governor.

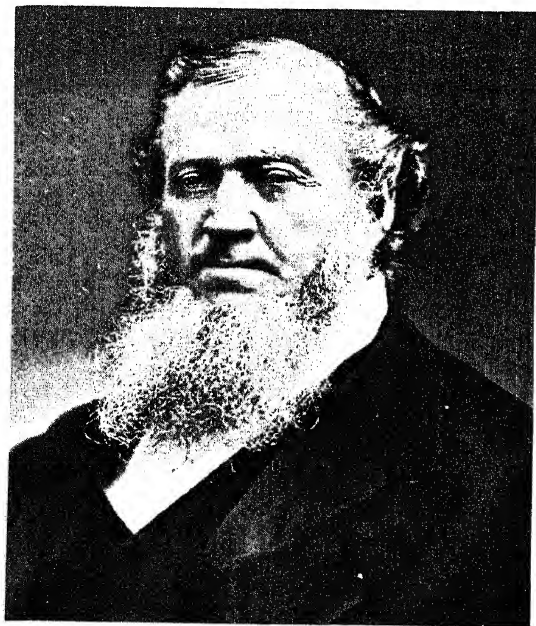
In August, 1852, Young publicly endorsed the doctrine of polygamy (q.v.), basing his pronouncement on a revelation said to have been experienced by Joseph Smith in 1843. His open advocacy of the doctrine disturbed the Federal government and the non-Mormon residents of Utah. Finally, in 1857, President James Buchanan (q.v.) appointed a new territorial governor. Young refused to relinquish his post, and when rumors of an armed Mormon rebellion reached Washington, the President sent a body of Federal troops to Utah. Hostilities were averted, largely as a result of Young's statesmanship, and the new governor was installed without incident. Nonetheless, as president of the church, Young continued to play a dominant role in Utah. In 1871 he was indicted on a polygamy charge but was not convicted. Young is believed to have married twenty-seven times and was survived by seventeen wives and fifty-seven children.

YOUNG, Charles Augustus (1834–1908), American astronomer, born in Hanover, N.H., and educated at Dartmouth College. He was professor of mathematics, natural philosophy, and astronomy at Western Reserve College from 1857 to 1866, when he was appointed professor of natural philosophy and astronomy at Dartmouth. In 1877 he became professor of astronomy at Princeton University and remained in that post until 1905. Young specialized in research into the physics of solar activity and was a pioneer in the application of spectroscopic methods to astronomical studies; see **SPECTRUM: Spectroscopes**. He is noted particularly for his discovery in 1870 of the so-called reversing layer above the solar photosphere; see **SUN**. His works include *The Sun* (1882), *Elements of Astronomy* (1890), and *Manual of Astronomy* (1902).

YOUNG, Cy, real name DENTON TRUE YOUNG (1867–1955), American baseball player, born in Gilmore, Ohio. In 1890, after playing for the Canton, Ohio, team of the Tri-State League,

Brigham Young

American Museum of Photography



he became a pitcher with the Cleveland, Ohio, club, then in the National League. Leaving the Cleveland team in 1898, he played for the Saint Louis (Mo.) Cardinals of the National League (1899–1900) and the Boston (Mass.) Red Sox of the American League (1901–08). On May 5, 1904, Young allowed no batters to reach first base, thereby becoming the first player in major-league history to pitch a perfect game. He retired from baseball in 1911, after playing two seasons for the Cleveland (Ohio) Indians of the American League and part of a season for the Boston (Mass.) Braves of the National League. During his twenty-two years in the major leagues Young pitched three no-hit games. He pitched in 906 games and won 511, setting two records that have never been equaled. In 1937 he was elected to the National Baseball Hall of Fame; see *BASEBALL HALL OF FAME AND MUSEUM, NATIONAL*.

YOUNG, Edward (1683–1765), British poet, born in Upham, Hampshire, England, and educated at the University of Oxford. His tragedies *Busiris* and *Revenge* were produced at the Drury Lane Theatre in 1719 and 1721, respectively. These works were followed by *The Universal Passion* (1725–28), a collection of verse satires that was highly acclaimed. From 1730 until his death Young served as rector at Welwyn, Hertfordshire. There he wrote his masterpiece, *The Complaint, or Night Thoughts on Life, Death and Immortality* (1742–45), a long meditative essay in blank verse. Abounding in macabre imagery, *Night Thoughts* was the fountainhead of the so-called graveyard school of poetry. His poetry, now largely unread, influenced the development of Romanticism (q.v.) in England. His prose writings include *Conjectures on Original Composition* (1759), an essay in literary criticism that stresses the primary importance in poetry of individual genius.

YOUNG, Owen D. (1874–1962), American lawyer and financier, born in Van Hornesville, N.Y., and educated at Saint Lawrence University and Boston University Law School. He practiced law in Boston from 1896 to 1912, when he was appointed general counsel of the General Electric Company. In 1919 Young supervised the formation of the Radio Corporation of America. He served as chairman of its board of directors from 1922 to 1939 and as acting chairman from 1942 to 1944. After World War I, he became a member of the committee of experts established by the Allied Reparations Commission; see *REPARATIONS*. He helped to draft the Dawes Plan, which set forth the manner of payment and the yearly sum required from the German government. In

1929 he formulated the so-called Young Plan of Reparations, that superseded the Dawes Plan. **YOUNG, Thomas** (1773–1829), British physician, physician, and Egyptologist, born in Milverton, Somersetshire, England, and educated at Edinburgh, Göttingen, and Cambridge universities. In 1796 he obtained a medical degree at Göttingen, and in 1799 he began to practice medicine in London. From 1802 until his death he was foreign secretary of the Royal Society. In 1811 Young was appointed to the staff of Saint George's Hospital, London. He served on several official scientific commissions, and after 1818 he was secretary to the Board of Longitude and editor of the *Nautical Almanac*.

Young is best known for his outstanding contributions in the field of optics (q.v.). He discovered the phenomenon of interference (q.v.), which helped to establish the wave nature of light. He was the first to describe and measure astigmatism (see *VISION: Sight Defects*) and to develop a physiological explanation of color sensation. Young is noted also for his work on the theories of capillarity and of elasticity (qq.v.). He also assisted in deciphering the Egyptian hieroglyphics inscribed on the Rosetta Stone (q.v.). Among his important writings are works on medicine, Egyptology, and physics.

YOUNG, Whitney M(oore), Jr. (1921–71), American Negro civil-rights leader and social worker, born in Lincoln Ridge, Ky. After receiving his B.S. degree from Kentucky State College

Whitney M. Young, Jr.



YOUNG MEN'S AND YOUNG WOMEN'S HEBREW ASSN.

in 1941, he served in the United States Army in Europe in World War II. After his discharge he did graduate work at Massachusetts Institute of Technology and the University of Minnesota, from which he received an M.A. degree in 1947. In 1948 he joined the National Urban League (q.v.) as industrial relations secretary for the affiliate in Saint Paul, Minn. In 1950 Young moved to Omaha, Nebr., to become executive secretary of the Omaha branch of the Urban League; he also lectured at the University of Nebraska School of Social Work and at Creighton University in Omaha. Beginning in 1954 Young served as dean of the Atlanta (Ga.) University School of Social Work. He left that position in 1961 to become executive director of the National Urban League at its headquarters in New York City. Among the programs proposed by Young was the so-called domestic Marshall plan, the aims of which were to bring social, economic, and educational benefits to deprived Negroes.

See also NEGROES IN THE UNITED STATES: *History: The Civil-Rights Movement*.

YOUNG MEN'S AND YOUNG WOMEN'S HEBREW ASSOCIATION (Y.M.-Y.W.H.A.).

See JEWISH COMMUNITY CENTER.

YOUNG MEN'S CHRISTIAN ASSOCIATION, known as Y.M.C.A., international organization fostering constructive social, physical, and educational activities for youths and adults of both sexes. The association adheres to Christian principles, but imposes no religious qualifications on its members. In 1972 the world body, known as the World's Alliance of Y.M.C.A.'s, consisted of 85 national councils, which in turn consisted of 1240 local associations. The United States had 1834 Y.M.C.A. branches and a membership of 5,407,712.

Activities. Facilities of a Y.M.C.A. branch commonly include a gymnasium and swimming pool, social and hobby center, classrooms and workshops, and modern living accommodations. Specialized programs are maintained for railroad and industrial workers, college students, armed forces personnel, and a variety of cultural and age groups. Notable among the teen-age groups are Hi-Y clubs for high-school boys, which teach democracy in practice as well as theory. Members often make field trips to State legislatures and government agencies. A companion Y.M.C.A. group, the Tri-Hi-Y, functions similarly among girls. Other popular activities include summer camping, vocational and personal counseling, father-and-son Indian Guide projects, and a full schedule of day and night classes. In 1972 about 3,131,370 persons participated in Y.M.C.A. courses of instruction;

6,300,000 persons registered in groups, of which classes are one category. More than 32,000,000 adults attended "Y"-sponsored events. In 1972 the Y.M.C.A. organization had 1,659,244 female members.

Affiliations. The great majority of Y.M.C.A. activities are led by volunteers, who number 522,026, compared with 52,702 paid leaders. Branches of the Y.M.C.A. are self-governed, independent units supported financially by United Fund (q.v.) drives, membership fees, and direct contributions by the public. Almost all Y.M.C.A. branches are affiliated with regional and State Y groups, as well as with the national council of Y.M.C.A.'s in the U.S., which helps set policy for local branches. Through its national board, the council also maintains research, publicity, and purchasing departments and publishes the *National Council Bulletin* and the *y.m.c.a. yearbook*. The International Committee of the U.S. and Canada operates Y.M.C.A. World Service. The American Y.M.C.A. movement also participates in the Y.M.C.A. World Alliance.

Notable Y.M.C.A. contributions to American life include the invention and development of basketball and volleyball (qq.v.). The Y.M.C.A. symbol is a red triangle representing spirit, mind, and body.

History. The Y.M.C.A. was founded in London in 1844 to combat unhealthy social conditions arising from the industrial revolution (q.v.). The expansion of commerce and industry brought many young men from rural areas into the industrial centers of Europe and England. After working hours these youths were often drawn toward gambling houses, cheap dance halls, and other undesirable establishments. In 1844 the British humanitarian Sir George Williams (q.v.) organized the first Young Men's Christian Association, which attempted to combat idleness among young businessmen by means of Bible classes and prayer meetings. The Y.M.C.A. idea proved highly popular, and by 1851 Great Britain had 24 associations with a combined membership of 2700.

The Y.M.C.A. movement spread to industrial centers in North America and Europe in 1851. On Dec. 29 of that year the first Y.M.C.A. in the U.S. was founded in Boston, Mass. Similar groups were founded in New York, Philadelphia, and other cities, and by 1854, 26 associations had been formed in the U.S. and Canada. During 1854 the first North American Y.M.C.A. convention was held in Buffalo, N.Y.

In Europe, George Williams and his associates introduced the Y.M.C.A. movement to Paris and other major capitals. By 1854, 397 associations

YOUNG WOMEN'S CHRISTIAN ASSOCIATION

had 30,360 members in seven countries. In the same year the first international Y.M.C.A. convention opened in Paris.

In 1861 the outbreak of the American Civil War virtually paralyzed the Y.M.C.A. movement in the U.S., but the adoption of a new war program soon revitalized the organization. In 1862 the association formed the first civilian volunteer organization dedicated to the welfare of war prisoners and other servicemen.

From 1878 to 1916 the scope and variety of Y.M.C.A. work increased steadily. During this period American membership rose from 99,000 to 600,000. Among the leaders directing the expansion of the Y.M.C.A. were the American educators Robert Ross McBurney (1837-98) and Luther Halsey Gulick (1865-1918). In 1885 a college for the training of Y.M.C.A. supervisory personnel was founded at Springfield, Mass.

During World War I the Y.M.C.A. accomplished a prodigious task of war relief and served, particularly, to aid the American Expeditionary Forces. The economic depression of the 1930's forced the Y.M.C.A. to curtail its program drastically. By 1940, however, membership had risen to 1,224,400 and combined capital investments totaled \$267,000,000.

In 1941 the Y.M.C.A. joined with six other organizations to form the United Service Organizations (q.v.), or U.S.O., which supplied entertainment, social services, and spiritual guidance for the U.S. armed services throughout World War II. After the war, the Y.M.C.A. instituted an extensive counseling program for armed-forces veterans.

YOUNGSTOWN, city of Ohio, in Mahoning and Trumbull counties, and county seat of Mahoning Co., on the Mahoning R., about 45 miles E. of Akron. The city is served by several railroads and airlines. An industrial center, Youngstown is one of the leading steel-producing centers in the United States. The city also has plants producing automobile parts, electronic equipment, pig iron, rubber products, and steel-mill equipment. Youngstown is the site of Youngstown State University, founded in 1908, and the Butler Art Institute.

The site of present-day Youngstown was part of the Western Reserve (q.v.) and was purchased about 1796 by John Young (1763-1825) a settler from New York for whom the city is named. Youngstown was incorporated as a town in 1848 and as a city in 1867; it became the county seat in 1876. Pop. (1960) 166,689; (1970) 139,788.

YOUNG TURKS. See *TURKEY: History: Constitutional Monarchy.*

YOUNG WOMEN'S CHRISTIAN ASSOCIATION, known as Y.W.C.A., international organization fostering personal and social development among young women. The organization, known officially as the World Young Women's Christian Association and consisting of branches in 83 countries in 1972, functions within the framework of Christian principles, but adherence to the Christian faith is not a pre-

Folk singers encourage their young audience to sing along during a special cultural event sponsored by a branch of the Y.W.C.A. of Philadelphia, Pa. Y.W.C.A.





A child explores the world of art in a pre-school project sponsored and staffed by the University chapter of the Y.W.C.A. at Berkeley, Calif.
Y.W.C.A.

requisite for membership. In the United States, the Y.W.C.A. is the parent body of a number of organizations, including the National Federation of Business and Professional Women's Clubs, the National Travelers Aid Association, and the Camp Fire Girls, Inc. (q.v.).

On a national level, Y.W.C.A. policy in the U.S. is determined by a board elected by delegates from the autonomous local branches in triennial convention. Local branches are financed through membership dues, private donations, funds collected in community money-raising drives, and, for special projects, supplementary grants from the national board. National publications include *Y Teen Scene* and *The YWCA Magazine*.

Activities. The program in each national branch of the World Y.W.C.A. varies, depending on the needs of the area it serves. In countries in which women have little education and few political rights, the organizations stress training in politics and world affairs, vocational education, and employment counseling. In the U.S. most local branches offer classes in calisthenics,

swimming, and team sports; social activities, discussion groups in religion and world affairs; workshop courses in crafts, dramatics, and photography; and facilities for personal and vocational counseling. About half of the local branches provide residence facilities for women.

Affiliations. The Y.W.C.A. of the U.S. is the largest branch of the world organization. Girls and women aged twelve and over are eligible for membership. The predominant groupings are Y Teens, consisting of children from twelve to eighteen years old; young adults, consisting of young women eighteen to thirty years old; and YW Wives, consisting of young married women. Men and boys may join the Y.W.C.A. as associates. Many branches provide child care for preschool children.

In the early 1970's U.S. membership and participants in the Y.W.C.A. totaled about 2,378,000. About 690 community Y.W.C.A.'s, branches, and centers; 160 Y.W.C.A. groups in small towns and rural communities; and 268 student associations were in operation, as well as 16 Y.W.C.A.

YOUNG WOMEN'S CHRISTIAN ASSOCIATION

United Service Organizations (q.v.). The paid professional staff numbered 3085, volunteers about 169,000. The Y.W.C.A. also worked in cooperation with the Federal government in operation of a vocational training program known as the Job Corps-Y.W.C.A. Residence Program.

In 1972 the American Y.W.C.A. gave assistance to forty-seven countries through the channels of the World Y.W.C.A. Mutual Service and Development Program. The organization provides funds to establish and build Y.W.C.A. facilities abroad and to meet emergencies caused by war or natural disaster. After World War II the Y.W.C.A., cooperating with other world organizations and with the United Nations, assisted in rehabilitating and resettling war victims.

History. The World Y.W.C.A. developed from two separate organizations established in England in 1855. One, called the Prayer Union, was designed to safeguard the spiritual welfare of women and girls; the other, known as the General Female Training Institute, was founded as a home for nurses returning from the Crimean War (q.v.). The organizations subsequently merged as the Young Women's Christian Association.

The movement spread to the U.S. in 1858, when the Ladies' Christian Association was founded in New York City to pray and labor for the "temporal, moral, and spiritual welfare of the self-supporting young woman". Later in 1858 an association established in Boston, Mass., to deal with the working conditions and housing problems of young working women became the first association to be known under the name now used.

Decent living quarters and spiritual guidance for young working women, particularly those separated from their homes and families, were the first concern of the American Y.W.C.A. During the last two decades of the 19th century its program was widened to include physical training and classes in sewing, typing, bookkeeping, science, music, and penmanship. Following the example of the Young Men's Christian Association (q.v.), or Y.M.C.A., the Y.W.C.A. also established college and university branches. A camping program to provide inexpensive summer vacations for working girls, was instituted with the opening (1874) of Sea Rest, a resort in Atlantic City, N.J. In its campaign to improve conditions for working girls and women, the Y.W.C.A. consistently pressed for remedial Federal legis-



Gymnasium class in an association established in Boston. The Massachusetts group was the first in the U.S. to use the name Young Women's Christian Association.

Y.W.C.A.

lation, including laws limiting the working day to eight hours and allowing the unrestricted organization of labor; see **LABOR LEGISLATION**; **WOMEN, EMPLOYMENT OF**. National headquarters of the Y.W.C.A. are located in New York City.

YPRES or **IEPER**, town of Belgium, in West Flanders Province, 28 miles s.w. of Bruges, and about 10 miles e. of the border with France. A textile center noted for its cotton and woolen goods, Ypres also produces soap, beverages, and metal products. Local points of interest include a Gothic cathedral and the Cloth Hall, both of which date from the 13th century and were restored after World War I. During the Middle Ages (q.v.) Ypres had an estimated population of 200,000 and was one of the foremost commercial centers of Europe. The town declined in commercial importance after the 16th century, largely because its strategic position made it a favorite battleground during wars between the major European powers. During World War I Ypres was the site of several major battles and was almost completely devastated. Pop. (1970 est.) 18,000.

YPRES, BATTLE OF, name applied to three battles of World War I (q.v.) fought in and around the town of Ypres, Belgium. Throughout the war Ypres was under constant attack as the key point of an Allied salient that blocked a German approach to the English Channel.

Battle of Ypres (Oct. 30–Nov. 24, 1914). The first battle at Ypres took place when outnumbered British, French, and Belgian troops resisted a German offensive aimed at the French ports of Calais and Dunkirk on the English Channel. The offensive, potentially disastrous to the Allied cause, was finally stemmed after thirty-four days of heavy fighting. The battle resulted in fixed military positions, initiating the long period of trench warfare on the western front.

Battle of Ypres (April 22–May 25, 1915). The second battle at Ypres occurred when the Germans carried out an experiment with a new military weapon, poisonous chlorine gas; see **GAS WARFARE**. After five weeks of fighting, a stalemate existed and the Germans brought the battle to an end. German losses totaled about 35,000 officers and men; Allied casualties numbered approximately 60,000.

Battle of Ypres (July 31–Nov. 10, 1917). Known also as the Passchendaele campaign, the third battle at Ypres was precipitated by a massive British offensive directed against enemy installations. In its initial phase the operation succeeded brilliantly. On June 7, 1917, British forces took the strategically important village of Mes-

sines, the heights of which commanded miles of German-occupied territory. The second phase of the offensive (July 31–Nov. 10) proved disastrous, however. Prolonged rainfall and heavy Allied bombardment had transformed the battlefield into an almost impassable swamp, and the Germans, operating from concrete pillboxes, took a heavy toll of Allied troops with mustard gas and machine-gun fire. After months of bitter fighting in deep mud, Canadian infantrymen captured the ruined village of Passchendaele. At this point the Allied command halted the offensive. Allied troops had pushed the German lines back only 5 mi. at a cost of 400,000 Allied casualties.

YPSILANTI, city of Michigan, in Washtenaw Co., on the Huron R., about 35 miles w. of Detroit. The city is served by railroad and a municipal airport. An educational and manufacturing center, in Ypsilanti are plants producing automobiles and automobile parts, and paper and paper products. Eastern Michigan University, established in 1849, is located in Ypsilanti. Settled in 1823 on the site of a French fur-trading post, Ypsilanti was chartered as a city in 1858. The city was named for Demetrius Ypsilanti (1793–1832), a hero of the Greek war for independence. Pop. (1960) 20,957; (1970) 29,538.

YSAYE, Eugène (1858–1931), Belgian violinist, born in Liège. He studied with both the Polish violinist Henryk Wieniawsky and the Belgian violinist Henri Vieuxtemps (qq.v.). Ysaye was concertmaster of a Berlin orchestra and later played on tour in Norway, Russia, France, and the United States. From 1886 to 1898 he was professor at the Conservatory of Brussels, where he organized the celebrated Ysaye quartet. In 1894 he established the Ysaye Concert Society in Brussels. After his retirement from the conservatory he continued to tour, and from 1918 to 1922 he was conductor of the Cincinnati Symphony Orchestra. The annual Ysaye International Violin Contest was inaugurated by the Belgian crown in 1937.

YTTERBIUM, or **ALDEBARANIUM**, bivalent or trivalent metallic element, belonging to the yttrium group of rare earths (q.v.), with at.no. 70, at.wt. 173.04, b.p. about 1430° C. (2606° F.), m.p. about 824° C. (1515.2° F.), sp.gr. 6.54 to 6.98, and symbol Yb; see **YTTRIUM**. It has a bright, silvery luster, and is soft, malleable, and quite ductile. Ytterbium is stable in air and reacts very slowly with water to liberate hydrogen. The Swiss chemist Jean Charles de Marignac (1817–94) separated a new substance from the rare earths in 1878 and named it ytterbium. In 1907 and 1908, however, the French chemist Georges Ur-

bain (1872–1938) and the Austrian chemist Carl Auer von Welsbach (q.v.) independently separated ytterbium into two elements. They named these elements neoytterbia or aldebaranium, now called ytterbium, and lutecia, now known as lutetium (q.v.). Ytterbium occurs in combination with such minerals as xenotime, euxenite, monazite, and gadolinite, and is usually extracted by distillation (q.v.). Ytterbium has potential applications in alloys, electronics, and magnetic materials.

YTTRIUM, trivalent metallic element, one of the rare earths (q.v.), with at.no. 39, at.wt. 88.92, b.p. 3304° C (5979.2° F), m.p. estimated 1530° C (2786° F), sp.gr. 4.48, and symbol Y. It was discovered by the Swedish chemist Carl Gustav Mosander (1797–1858) in 1842, and isolated by the German chemist Friedrich Wöhler (q.v.). It ranks twenty-eighth in abundance among the elements in the crust of the earth. Yttrium is found as an oxide in most of the rare-earth minerals. It oxidizes readily in air to the oxide Y_2O_3 , and dissolves in hot water to form the hydroxide $Y(OH)_3$. The radioisotope (see ISOTOPE) yttrium-91, produced in nuclear reactors, has a half-life (q.v.) of 57 days. Because of its high beta activity this isotope has important applications in the treatment of cancer. See NUCLEAR ENERGY.

YÜAN. See KUBLAI KHAN.

YÜAN KIANG, alternate name of a river in China. See RED.

YÜAN SHIH-K'AI (1859–1916), Chinese military leader and statesman, born in Hsiangcheng, Hohan Province. In 1885 he became the Chinese imperial resident in Korea, where he remained until 1894. In 1898 Yüan, after he prevented a plot against the Chinese empress dowager Tzu Hsi (q.v.) by disclosing to her the plans of the emperor, Kuang Hsü (1871–1908), was made governor of Shantung. He served as viceroy of Chihli (now Hopei) Province from 1901 to 1907. In 1908, after the deaths of Kuang Hsü and the empress dowager, he was forced into retirement by the regent of the new emperor.

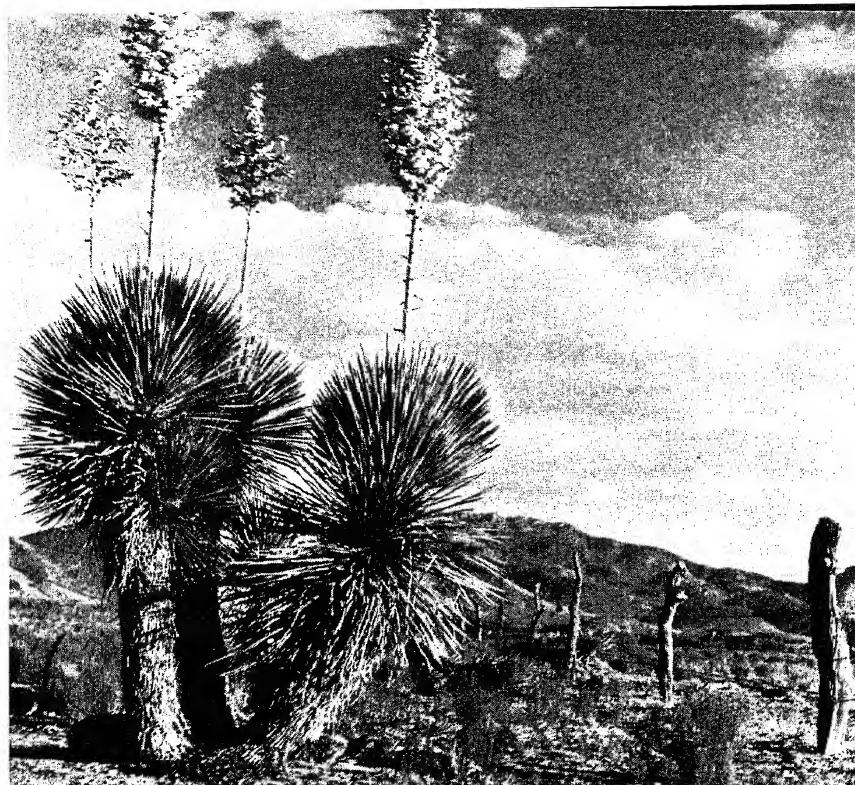
With the outbreak of revolution in 1911, Yüan was recalled to office and placed in charge of the imperial troops in northern China. By the last imperial edict of the Manchu regime, issued on Feb. 12, 1912, Yüan was appointed premier and authorized to form a republican government. Subsequently the revolutionary leader Sun Yat-sen (q.v.) resigned as provisional president of the Chinese republic in favor of Yüan, who held the provisional leadership until he was elected president in October, 1913. Within a year Sun and his party, the Kuomintang (q.v.), were outlawed, the parliament was dissolved,

and Yüan had assumed dictatorial control of China. Late in 1915 his adherents secured provincial approval of a plan to restore the monarchy, with Yüan as emperor. Rebellion in the southern provinces forced him to delay his accession to the throne, and in April, 1916, he relinquished executive authority to his advisory council. He died two months later. See CHINA, PEOPLE'S REPUBLIC OF: *History: Imperial Decay and Foreign Pressure: Reform Movements and the Boxer Rebellion*.

YUBA CITY, city in California, and county seat of Sutter Co., on the Feather R. about 40 miles N. of Sacramento. The city packs locally grown peaches, nuts, and plums, and cans the tomatoes and asparagus that are grown in the vicinity. Gold is mined in the area. Founded in 1849, Yuba City was incorporated as a town in 1878 and as a city in 1908. Pop. (1960) 11,507; (1970) 13,986.

YUCATÁN, in physical geography, peninsula of Central America, projecting into the Atlantic Ocean in a N.E. direction and separating the Gulf of Mexico from the Caribbean Sea. It contains the Mexican States of Yucatán, Campeche, Quintana Roo, and part of Tabasco; all of British Honduras (Belize); and part of N. Guatemala. Physiographically, the peninsula is a coralline limestone tableland with an average elevation of less than 500 ft., except in parts of the s. where projecting spurs rise to a height of about 1500 ft. Distinctive topographical features of the N. portion are the numerous limestone caverns and underground channels into which rainwater drains. The climate is generally hot, but the trade winds prevent the heat from becoming too intense. Maximum precipitation occurs during the summer season; the average rainfall ranges from about 20 in. annually in the N. to about 80 in. in the extreme s.

In the N., henequen (q.v.), used in the production of rope, abounds. Along the coast are turtles, which yield commercially valuable tortoise shell. In the humid s. sections are great forests of mahogany, vanilla, logwood, and other valuable timber. Agriculture is an important occupation of the peninsula and the chief crops include coffee, corn, cotton, sugar cane, and tobacco. The leading industry is the processing of henequen. The chief exports are chicle, used in the manufacture of chewing gum, and henequen. Most of the inhabitants of the peninsula are Maya Indians. The largest city of the peninsula is Mérida (q.v.), capital of Yucatán State; other important cities are Campeche, capital of Campeche State, and Belmopan (q.v.), capital of British Honduras. Points of interest in the penin-



Yucca, Yucca radiosa
Josef Muench

sula, and of great archeological importance, are the ruins of the highly developed ancient Mayan civilization at Chichén-Itzá (q.v.) and at Uxmal; see MAYA.

The first white men to explore Yucatán were the Spanish, who arrived early in the 16th century. The Spanish conquistador Hernando Cortes (q.v.) crossed the base of the peninsula in 1525. Spain began the conquest of the Mayas a few years later and by 1549 approximately half the peninsula was under its domination. Spanish hegemony over much of the region continued until early in the 19th century, when Mexico and Central America won independence. Yucatán and Campeche were constituted separate States in 1862 and Quintana Roo was made a territory in 1902 and a State in 1975. Area of the peninsula, about 70,000 sq.mi.

YUCCA, generic and common name of stiff-leaved, evergreen shrubs and trees belonging to the Lily family, Liliaceae. The genus contains about thirty species, which are native to North America and the West Indies. Several types are widely cultivated for their ornamental appearance and attractive flowers. The spearlike leaves are borne in tufts, and from the center of the tuft grows the large flower stalk, which bears a cluster of bell-shaped, drooping blossoms. Pollination rarely occurs except with the aid of the yucca moth (q.v.). The yucca is the State flower of New Mexico.

The Spanish bayonet, *Y. aloifolia*, native to the West Indies, Mexico, and the southeastern United States, bears white flowers and grows to a height of 25 ft. Spanish dagger, *Y. gloriosa*, is native to the Atlantic coast from North Carolina to Florida; it bears white, reddish-tinged flowers and reaches a height of 8 ft. Adam's needle, *Y. filamentosa*, native to the eastern U.S., bears whitish flowers and attains a height of 12 ft. The species *Y. glauca*, native to the plains, bears greenish-white flowers and reaches a height of 6 ft. A white-flowered species, *Y. radiosa*, is found in Texas, Arizona, and Mexico, and grows to a height of 20 ft. The Joshua tree, *Y. brevifolia*, is found in the Mojave Desert of the southwestern U.S. and grows to a height of 30 ft. The tree was so named because its branches recalled the arm of the prophet Joshua as he pointed, spear in hand, to the city of Ai. The western Spanish bayonet, or datil yucca, *Y. baccata*, is native to Nevada, New Mexico, and southern Colorado, and bears dark-purple, edible fruits. The mission bell, or Quixote plant, *Y. whipplei*, native to southern California, bears fragrant, creamy-white flowers and reaches a height of 6 ft.

The coarse fibers obtained from the stem and foliage of many yucca plants were used in the manufacture of cordage; see FIBER. Many yuccas of the southeastern U.S. have grasslike leaves, known as bear grass, which are used as filling

for chair cushions and pillows. The roots of some species yield a fatty substance used in some countries as a substitute for soap (q.v.). The name "yucca" is commonly but incorrectly applied to the date yuccas of the genus *Samuela*.

YUCCA HOUSE NATIONAL MONUMENT, area of historic interest in the State of Colorado, about 6 miles S.W. of Cortez. See NATIONAL PARK SERVICE.

YUCCA MOTH, common name of a small, white moth (q.v.), *Tegeticula yuccasella*, the sole insect pollinator of the plants known as yucca (q.v.). This species is found wherever yuccas grow wild, since the moths and the plants are interdependent for their respective reproduction. To accomplish the fertilization of the yucca flowers, the female lays several eggs in the pistil, collects a wad of pollen from the stamen, returns to the pistil containing the eggs, and inserts the pollen into the funnel-shaped stigma. Thus, she insures the growth of the seed pod, which provides the proper food for her offspring. The larvae destroy only a few of the seeds produced in the pod. The interdependence of yuccas and the yucca moths is an excellent example of symbiosis (q.v.).

YUGOSLAVIA, or JUGOSLAVIA, officially SOCIALIST FEDERAL REPUBLIC OF YUGOSLAVIA, nation of S.E. Europe, on the Balkan Peninsula (q.v.). Yugoslavia is bounded on the N. by Austria and Hungary, on the E. by Rumania and Bulgaria, on the S. by Greece and Albania, and on the W. by Albania, the Adriatic Sea, and Italy. The country lies between about lat. 40°51' N. and lat. 46°53' N. and between long. 13°23' E. and long. 23°02' E. It is the largest country on the Balkan Peninsula, with an area of 99,079 sq.mi.

THE LAND

About three quarters of Yugoslavia is mountainous or hilly and about one quarter is lowland plain. Extensions of the Alps, including the Julian Alps, occupy the N. portion of the country. Triglav (9393 ft.), the highest peak in Yugoslavia, is in this region. Western Yugoslavia is traversed by the Dinaric Alps, consisting of several parallel ranges. The coastal range is partially submerged, a phenomenon that accounts for numerous bays, gulfs, and inlets, and more than 1000 offshore islands. Among other topographic features of the coastal region are occasional torrential rivers, numerous springs, and discontinuous strips of fertile land along the base of the uplift.

View of Belgrade from the Sava River.



YUGOSLAVIA

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Macedonia (rep.)	E 4, F 4
Montenegro (rep.)	D 3
Serbia (rep.)	D 2, E 3
Slovenia (rep.)	B 2
Vojvodina (aut. prov.)	D 2, E 2

Cities and Towns

Aleksinac	E 3
Apatin	D 2
Backa Topola	D 2
Banja Luka	C 2
Banovići	D 2
Bečej	E 2
Bela Crkva	E 2
Belgrade (Beograd) (cap.)	F 1
Bihać	B 2
Bijeljina	D 2
Bijelo Polje	D 3
Bitola	E 4
Bjelovar	C 2
Bled	B 1
Bor	F 2
Bosanska Dubica	C 2
Bosanska Gradiška	C 2
Bosanska Krupa	C 2
Bosanski Brod	D 2
Bosanski Novi	C 2
Bosanski Petrovac	C 2
Brčko	D 2
Bugojno	C 2
Čačak	E 3
Celje	B 1
Cetinj	D 3
Čuprija	E 3
Debar	E 4
Derвента	C 2
Dimitrovgrad	E 3
Djakovica	E 3
Djakovo	D 2
Dubrovnik	C 3
Fiume (Rijeka)	B 2
Foča	D 3
Gevgelija	F 4
Gnjilane	E 3
Gornji Milanovac	D 2
Gospić	B 2
Gračanica	D 2
Gradačac	D 2
Herceg Novi	D 3

Idrija	B 1
Ivangrad	D 3
Jajce	C 2
Janja	D 2
Jesenice	A 1
Kamenik	B 1
Kanjiža	E 1
Karlovac	B 2
Kavadarci	E 4
Kičevo	E 4
Kikinda	E 2
Knin	C 3
Knjaževac	F 3
Kočevo	B 2
Konjic	D 3
Koper	A 2
Koprivnica	C 1
Kosovo Polje	E 3
Kosovska Mitrovica	E 3
Kotor	D 3
Kragujevac	E 2
Kraljevo	E 3
Kranj	B 1
Križevci	C 1
Kruševac	E 3
Kumanovo	E 5
Leskovac	E 3
Livno	C 3
Ljubljana	B 2
Loznica	D 2
Maglaj	D 2
Majdanpek	F 2
Maribor	B 1
Modriča	D 2
Mostar	C 3
Nasiče	C 2
Negotin	F 2
Nikšić	D 3
Niš	E 3
Novi Beograd	F 1
Novi Pazar	E 3
Novi Sad	D 2
Novo Mesto	B 2
Novska	C 2
Ogulin	B 2
Ohrid	E 4
Opatija	B 2
Osjek	D 2
Paraćin	E 3
Peć	E 3
Petrinja	C 2
Piran	A 2
Pirot	F 3
Piljevlja	D 3
Poreč	A 2
Postojna	B 2
Požarevac	E 2
Požega	E 3

Preševo	E 3
Prijedor	D 3
Prijepolje	C 2
Priepolje	D 3
Prilep	E 4
Priština	E 3
Prizren	E 3
Prokuplje	E 3
Ptuj	B 1
Pula	A 2
Radoviš	F 4
Ragusa (Dubrovnik)	C 3
Raška	E 3
Rijeka	B 2
Rogatica	D 3
Rovinj	A 2
Ruma	D 2
Sabac	D 2
Sanski Most	C 2
Sarajevo	D 3
Senj	B 2
Senta	D 2
Sibenik	C 3
Sinj	C 3
Sisak	C 2
Škofja Loka	B 1
Škopje	E 3
Skradin	B 3
Juzna Morava Požega	C 2
Slavonski Brod	D 2
Smederevo	E 2
Sombor	D 2
Split	C 3
Sremska Mitrovica	D 2
Štip	F 4
Struga	E 4
Strumica	F 4
Subotica	D 1
Surdulica	F 3
Svetozarevo	E 3
Svilajnac	E 2
Tešanj	C 2
Tetovo	E 3
Titograd	D 3
Titovo Užice	D 3
Titov Veles	F 4
Travnik	C 2
Trbovlje	B 1
Trebinje	D 3
Trogir	C 3
Tržič	B 1
Tuzla	D 2
Ulcinj	D 4
Valjevo	D 2
Varaždin	C 1
Vareš	D 2
Vinkovci	D 2
Virovitica	C 2

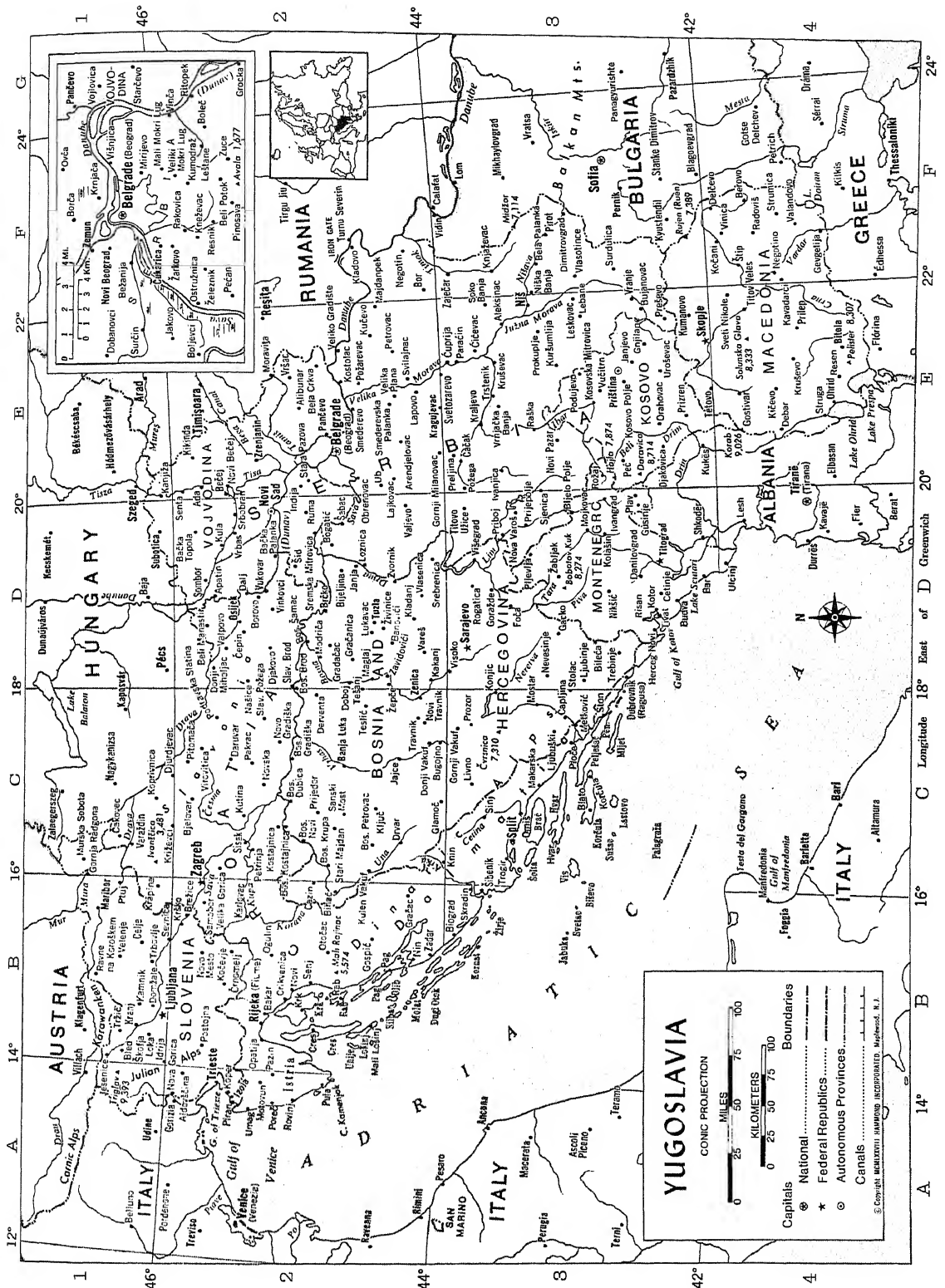
Višegrad	D 3
Vranje	F 3
Vrbas	D 2
Vršac	E 2
Vukovar	D 2
Zadar	B 2
Zagreb	C 2
Zaječar	F 3
Zenica	D 2
Zrenjanin	E 2
Zvornik	D 2

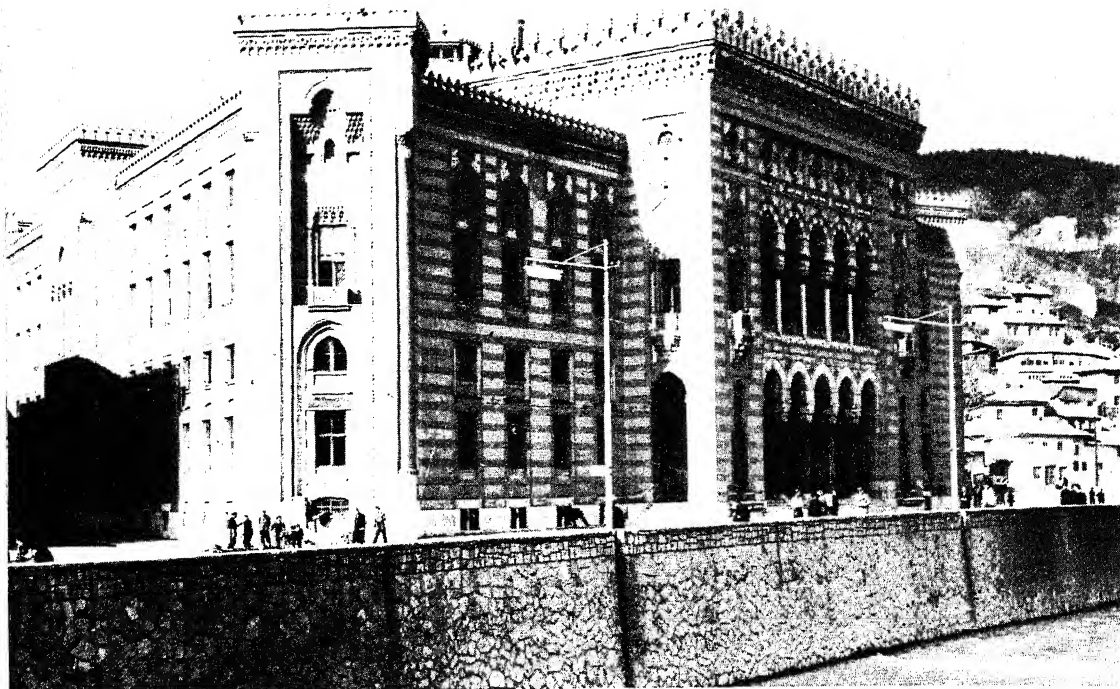
Physical Features

Bobotov Kuk (mt.)	D 3
Bosna (riv.)	D 2
Brač (isl.)	C 3
Cres (isl.)	B 2
Dalmatia (reg.)	C 3
Danube (riv.)	E 2
Dinaric Alps (mts.)	B 2, C 3
Drava (riv.)	C 2
Dnna (riv.)	D 2
Dugi Otok (isl.)	B 2
Hvar (isl.)	C 3
Ibar (riv.)	E 3
Iron Gate (gorge)	F 2
Istria (pen.)	A 2
Juzna Morava (riv.)	E 3
Kamenjak (cape)	A 2
Korab (mt.)	E 4
Korčula (isl.)	C 3
Kornat (isl.)	B 3
Lastovo (isl.)	C 3
Lim (riv.)	D 3
Lošinj (isl.)	B 2
Mijet (isl.)	C 3
Mura (riv.)	B 1
Neretva (riv.)	D 3
Ohrid (lake)	E 4
Pag (isl.)	B 2
Palagruža (isl.)	C 3
Prespa (lake)	E 4
Rab (isl.)	B 2
Ruen (Rujen) (mt.)	F 3
Sava (riv.)	D 2
Scutari (lake)	D 3
Slavonia (reg.)	C 2
Šolta (isl.)	C 3
Tara (riv.)	D 3
Timok (riv.)	F 2
Tisa (riv.)	E 2
Triglav (mt.)	A 1
Una (riv.)	C 2
Vardar (riv.)	F 4
Velika Morava (riv.)	E 2
Vis (isl.)	C 3
Vrbas (riv.)	C 2
Zirje (isl.)	B 3

The s. coastal region is known generally as Dalmatia (q.v.) Much of the Dinaric region inland from the coastal range is the Karst, a barren limestone plateau broken by depressions and ridges, averaging less than 2000 ft. in elevation. The Dinaric uplifts e. of the plateau are forested and considerably more elevated; the highest Dinaric summit is Djeravica (8740 ft.). High uplifts occur in s. Yugoslavia; Korab (9068 ft.), on the Albanian frontier, is the highest peak in this region. Outcroppings of the Balkan Mts. and the Rhodope Mts. occur in the s.e. section of

Yugoslavia, which is traversed by the Vardar and Morava rivers. The most extensive lowlands are situated in the n.e. These lowlands, geologically an extension of the Alföld, the plain of Hungary, comprise a region of great fertility. The plain is traversed by the Danube R. and several of its tributaries, including the Drava, Sava, and Tisza rivers. In addition, important features of the hydrographic system include three large lakes, namely Lake Scutari and Lake Ohrid, which lie partly in Albania, and Lake Prespa, which lies partly in Albania and partly in Greece





The town hall of Sarajevo, designed in Moorish-Byzantine style.

Yugoslav Information Center

Climate. Yugoslavia has a highly diversified climate. The N. regions are under continental influence and have warm summers and cold winters, with heavy snows at the higher altitudes. In the S., particularly along the Adriatic coast, a Mediterranean climate prevails, with warm, dry summers and mild, rainy winters. The annual temperature ranges between 120° F. in the summer to -15° F. in winter. Annual precipitation varies from about 30 in. along the coast to 80 in. in the mountains.

Natural Resources. Minerals are the primary natural resource of Yugoslavia, its deposits of antimony, lead, and bauxite being among the most significant in Europe. Other principal reserves are bituminous coal in E. Serbia, iron ore in central Bosnia and Hercegovina, copper in E. Serbia, natural gas and petroleum in N.E. Slovenia, zinc in east-central Serbia and N.E. Croatia, chromium in N. Macedonia and N. Serbia, and bauxite in the Karst regions of S.W. Croatia.

Lignite, manganese, gold, mica, phosphorus, sulfur, asbestos, molybdenum, cobalt, and tungsten are found in small amounts throughout the country.

Plants and Animals. In the coastal area the vegetation is predominantly subtropical. The chief trees of this area are the palm, cypress, olive, orange, lemon, fig, and cherry; in addition, evergreens, pomegranate shrubs, and

grapevines are abundant. Other plants of the coastal area include the wild pyrethrum, rosemary, sage, and laurel. In the lower mountain regions the deciduous trees include the oak, elm, maple, walnut, chestnut, willow, poplar, ash, and linden, as well as the plum, apple, and pear. At higher altitudes conifers, including the pine, fir, and juniper, are characteristic of plant life.

The forests and mountains abound in large mammals, including the chamois, deer, roebuck, bear, boar, and lynx. Small mammals, such as the rabbit, fox, otter, badger, squirrel, and weasel, are common in all parts of the country. Bird life includes various species of duck and goose and the eagle, heron, stork, magpie, crow, bluejay, dove, quail, pheasant, and partridge. Fish are abundant in the streams and lakes; among the principal freshwater species are the carp, catfish, sturgeon, pike, perch, trout, and eel. In the Adriatic Sea are several hundred species of fish, of which the most important for commercial fishing are the sardine, tuna, and mackerel.

Soils. Most of the mountainous regions, which comprise about half of the area of Yugoslavia, are covered by relatively infertile gray podzolic soils composed chiefly of sand and small quantities of clay, iron oxides, and humus. The most fertile soil is a rich black earth found in the Alföld. Also broad belts of fertile alluvial soils lie along the rivers which flow through the Alföld and along the valleys of the Morava and Vardar rivers in the S.E. Relatively fertile brown-earth

soils are found in parts of Serbia and Macedonia. Most of the soils along the Adriatic coast are of the red-earth variety, high in iron content and low in humus. Scattered throughout the mountainous regions of the country are areas with shallow layers of a dark-colored earth suitable for grass crops.

Waterpower. Total electric power production in Yugoslavia during the mid-1970's was about 35 billion kw hours annually. Approximately 16.4 billion kw hours were produced in hydroelectric plants.

THE PEOPLE

Most inhabitants of Yugoslavia belong to the southern group of the Slavs (q.v.); the name "Yugoslavia", in the Serbo-Croatian language *Jugoslavija*, means "land of the south Slavs". The principal south Slav groups in Yugoslavia, together with the percentage which each comprises of the total national population, are the Serbian (41), Croat (23), Slovene (9), Macedonian (5), and Montenegrin (3). Other Slavic elements, which together make up slightly more than 1 percent of the population, are the Slovak, Bulgarian, Czech, Ruthenian, and Russian.

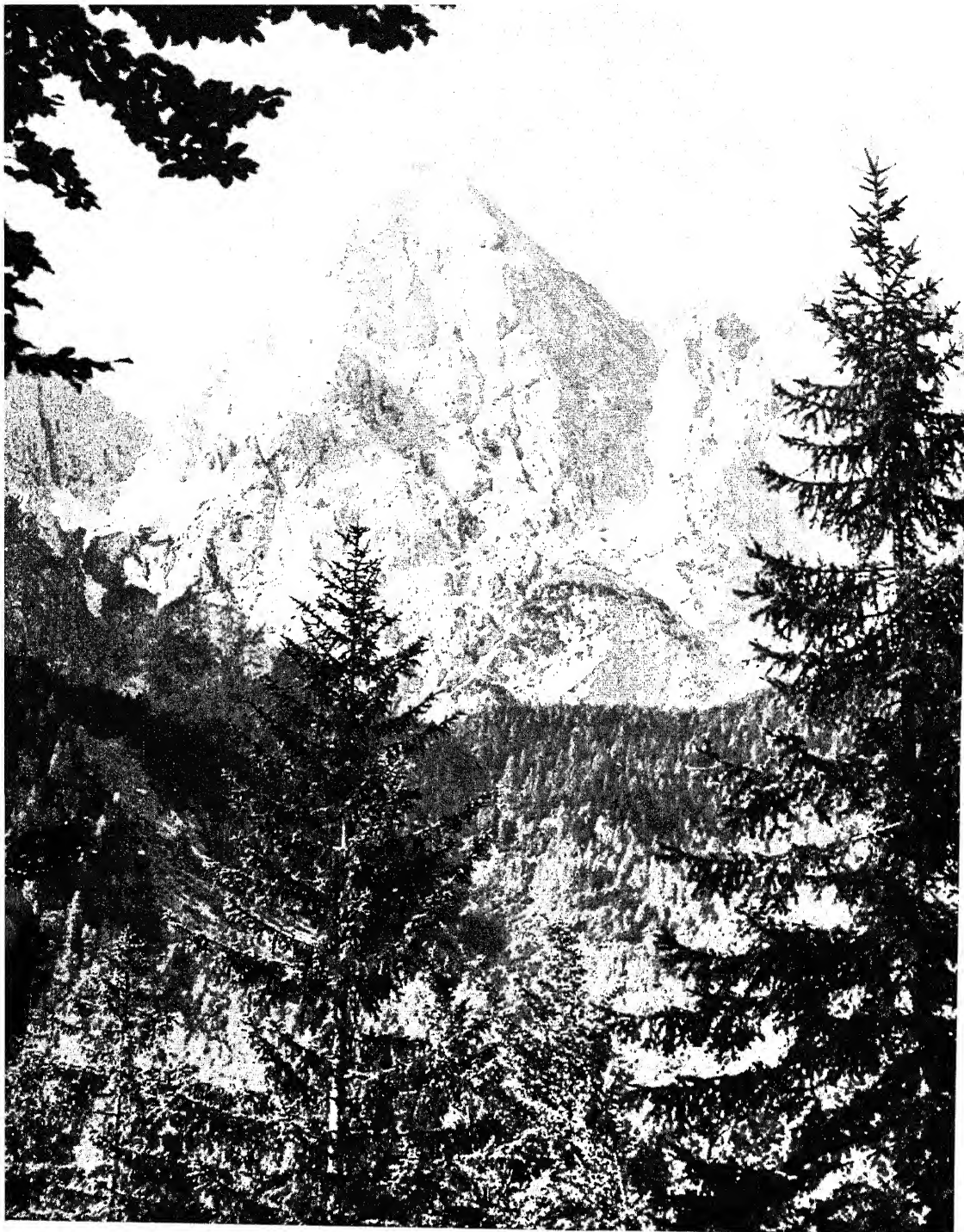
About 11 percent of the population consists of non-Slavic peoples, including Albanians, Hungarians, Turks, Germans, Rumanians, Vlachs, and Italians. About 6 percent of the population is classified officially as "unspecified Yugoslavs", a term which designates Muslims of Serbian or Croatian origin.

Population. The population of Yugoslavia (census 1971) was 20,504,216. The overall population density is about 208 persons per sq.mi. (1971 est.), but varies widely from a maximum of 221 persons per sq.mi. in Serbia to a minimum of 88 per sq.mi. in Montenegro. Approximately 59 percent of the population of Yugoslavia is classified as rural.

Political Divisions. The federal republic is composed of six constituent republics and two autonomous provinces. The constituent republics, in descending order of size, are Serbia, Croatia, Bosnia and Hercegovina, Macedonia, Slovenia, and Montenegro. The two autonomous provinces of Vojvodina and Kosovo are taken statistically as part of Serbia.

Viaduct on the Jadranska Magistrala, the Adriatic highway on the Croatian seacoast. Yugoslav Information Center





An Alpine scene in Slovenia, in northwestern Yugoslavia.

Yugoslav State Tourist Office

Principal Cities. Belgrade, the capital and largest city of Yugoslavia, had a population (1971) of 741,618. Other major cities include Zagreb (566,084), capital of Croatia and the financial and trading center of Yugoslavia; Skopje

(312,091), capital of Macedonia and an important commercial and industrial city; Sarajevo (244,055), capital of Bosnia and Hercegovina and a commercial and railroad center; and Ljubljana (174,000), capital of Slovenia.

Religion. The Yugoslav constitution guarantees separation of church and state and freedom

of religion. In the early 1960's about 42 percent of the population were Orthodox Christians, 32 percent Roman Catholics, and 13 percent Muslim. The remainder were chiefly Protestants.

Languages. The three official languages in Yugoslavia are Serbo-Croatian (q.v.), Slovenian, and Macedonian. The first-named language is spoken by about 75 percent of the population. Slovenian and Macedonian are closely related to Serbo-Croatian. See SLAVIC LANGUAGES.

Education. Elementary education is compulsory for all children between the ages of seven and fifteen, and all schooling is free. Approximately 80 percent of the population is literate, although the percentage varies in each republic. The educational system of Yugoslavia is financed and administered by the federal government.

ELEMENTARY AND SECONDARY SCHOOLS. In the early 1970's about 2,830,000 students annually attended about 14,000 primary schools; about 186,000 students were enrolled in about 420 secondary schools; and about 600 vocational secondary schools were attended by approximately 201,000 students.

SPECIALIZED SCHOOLS. A system of school centers is closely connected to industrial and government agencies, which train personnel for specific jobs. About 700 such school centers were attended by about 250,000 students annually, and almost 98,000 Yugoslavs attended about 740 adult-education schools in the early 1970's. National minorities also have their own elementary and secondary schools.

UNIVERSITIES AND COLLEGES. About 250 colleges and universities were attended by more than 260,000 students annually in the early 1970's. The major universities are the University of Belgrade and the University of Zagreb.

Culture. The cultural heritage of Yugoslavia is very complex, and the cultures of its different regions vary greatly. Croatia and Slovenia, for instance, were long influenced by Austria, Hungary, and, accordingly, by the Roman Catholic Church. In Serbia, for centuries a part of the Ottoman Empire (q.v.), Islamic culture took root. Major cultural influences in Macedonia have been Hellenic and Turkish, and those on the Dalmatian coast Slavic and Italic. The people of Montenegro on the other hand were isolated in mountainous terrain and have developed a simple pastoral culture.

LIBRARIES AND MUSEUMS. In the mid-1960's, Yugoslavia had about 3500 public libraries with a total collection of more than 13,000,000 volumes. The capital city of each of the six republics is the location of important libraries. The



Young boys carry water on the handlebars and backs of their bicycles near Kladanj, in the Republic of Bosnia and Hercegovina. UPI

most important museums are the Ethnographic Museum in Belgrade, and the Archeological museum in Zagreb. Of more than 250 museums maintained throughout the country more than half are sociohistorical.

LITERATURE. At the end of the 19th century Yugoslav literature joined the great stream of European literature with groups of modernist and expressionistic writers. Best known among contemporary Yugoslav writers is Milovan Djilas (1911–). His works include *Land Without Justice*, an autobiography of his youth, and *The New Class*, widely regarded as an indictment of Communist bureaucracy. Ivo Andric (q.v.), author of *Bridge on the Drina*, won the 1961 Nobel Prize in literature.

Art and Music. Both early and contemporary Yugoslav art varies from region to region, reflecting diverse foreign influences. Among the notable developments have been the tomb sculpture in medieval Bosnia and Hercegovina

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and the 19th-century tomb painting in Serbia. Modern painting, centered in Belgrade, Ljubljana, and Zagreb, has reflected Western art movements, such as impressionism and expressionism. Also, a group of *Zemlja* (land) artists was formed in 1928 to develop an art easily comprehensible to the common people, from which trend the primitivist paintings of Krsto Hegedušić (1901–) and Ivan Generalić (1914–) evolved. Since 1945 Communists have attempted to impose Soviet realism; nonetheless, nearly all modern art movements are represented in Yugoslavia. Among the world-famous contemporary Yugoslav artists are the still-life painter Predrag Milosavljević (1908–) and the painter Petar Lubarda (1907–). Among recognized 20th-century sculptors is the Yugoslav Ivan Meštrović (q.v.), who based many works on Biblical themes. Two of his statues of American Indians are in the Museum of Art, Chicago, Ill.

Yugoslavia has had several important modern composers and musical artists. Among the former are Jakov Gotovac (1895–) and Stevan Hristić (1895–1958). Among the latter is soprano Zinka Milanov (1906–), long a member of the New York Metropolitan Opera Company.

THE ECONOMY

The economy of Yugoslavia is centrally planned and is generally similar to that of the U.S.S.R. and other Communist states. All industry, trade, and transport are nationalized, and agriculture is partly collectivized. Since 1950, however, management groups in most sectors of the economy have independently controlled, within clearly defined limits, both production and finance. Once primarily an agricultural nation, Yugoslavia has grown increasingly industrial since World War II, and by the mid-1970's industry accounted for about 40 percent of the national income. In a recent year national budget figures showed about \$4.28 billion in revenues and \$4.22 billion in expenditures.

Agriculture. Approximately 40 percent of the total land area is devoted to agriculture, and about 45 percent of the economically active population engages in farming. Each private holding is limited by law to 25 acres, and the government has paid compensation for expropriated lands. In the mid-1970's private holdings totaled about 2,600,000, covering about 85 percent of the arable land. At the same time there were more than 1940 socialized farms and peasant cooperatives, which employed about 137,000 persons, or only about 3 percent of those engaged in agriculture.

In the mid-1970's the principal crops produced included wheat (4,405,000 metric tons an-

nually), rye (98,000 tons), barley (703,000 tons), corn (9,389,000 tons), potatoes (2,394,000 tons), and tobacco (70,300 tons). Other important crops are sugar beets, flax and hemp, and grapes, plums, and other fruits. A substantial amount of wine is produced. The livestock population in the mid-1970's included some 5,870,000 cattle, 8,180,000 sheep, 7,680,000 hogs, 920,000 horses, and 54,700,000 poultry.

Forest and Fishing Industries. Forests cover about 30 percent of the country's area. Two thirds of the forest land is state property; the remaining third is held by individuals and cooperatives. Roundwood production was over 19,000,000 cu.yd. annually in the mid-1970's.

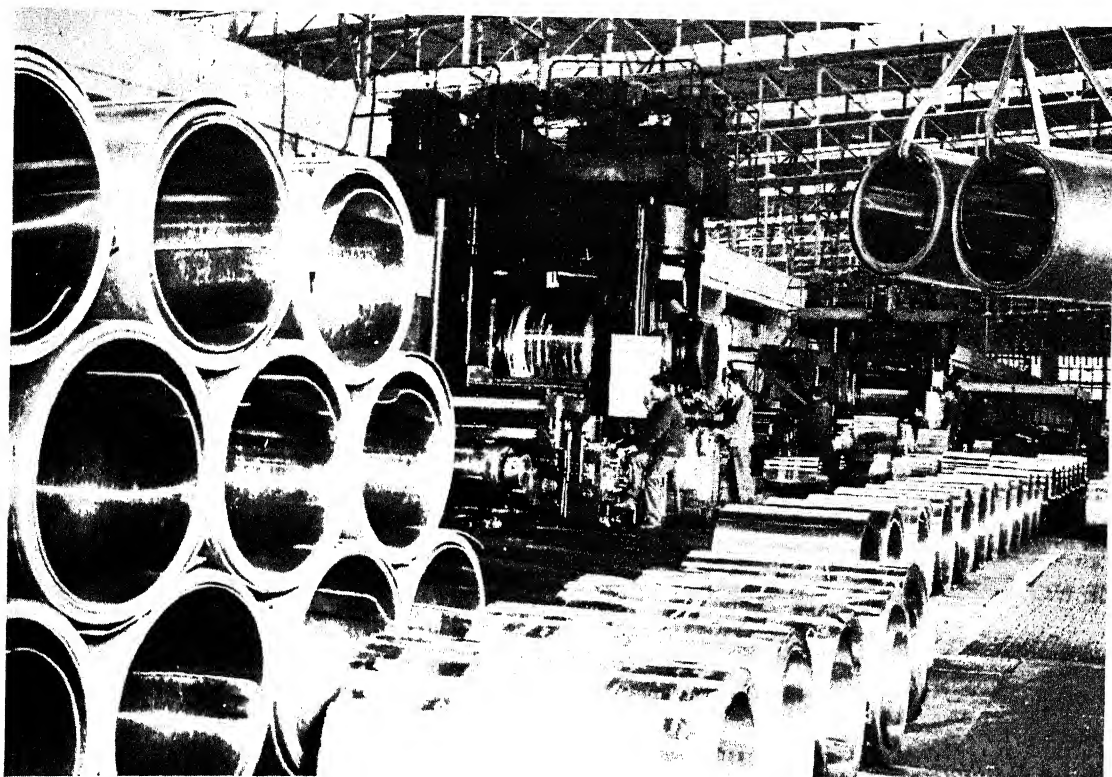
Fishing is among the less important industries, the total catch averaging some 56,000 tons annually in the mid-1970's. Of this total, about 32,000 tons were saltwater species, chiefly sardines and tuna. The fishing fleet comprised about 205 motor vessels and 1700 sailing and rowing vessels.

Mining. All subsurface minerals are the property of the state. Annual mineral production in the mid-1970's, in metric tons of metal content of ore, included copper (114,900), iron (1,928,000), manganese (5400), lead (126,900), zinc (103,400), and antimony (2183). In addition, 598,000 tons of coal, 34,939,000 tons of brown coal and lignite, and 2,306,000 tons of bauxite were produced.

Manufacturing. The majority of the nation's manufacturing plants are located in the republics of Croatia and Slovenia in the northwest. The major industries, with approximate annual output in the mid-1970's, included cement (7,065,000 tons), steel (2,916,000 tons), pig iron and ferroalloys (2,193,000 tons), sulfuric acid (871,000 tons), aluminum (168,300 tons), cotton fabrics (448,500,000 sq.yd.), and woolen fabrics (78,935,000 sq.yd.). Iron and steel castings, refined copper, agricultural machinery, and bicycles are also produced in significant volume.

Currency and Banking. The unit of Yugoslav currency is the dinar, which is divided into 100 paras. In 1966, 12.5 dinars were equal to U.S.\$1; in January, 1971, the dinar was devalued by 16.7 percent. In 1977 the rate of exchange was 17.4 dinars to U.S.\$1. Coins are minted in denominations of 50 paras and 1, 2, 5, 10, 20, and 50 dinars; paper notes are issued in denominations of 5, 10, 50, and 100 dinars.

All banks are owned by the state. The National Bank of Yugoslavia is the sole bank of issue. Other banks extend credit to agricultural or industrial enterprises or accept savings accounts.



Copper and copper-alloy products are manufactured in a rolling mill at Sevojno in Serbia.

Yugoslav Information Center

Commerce and Trade. All wholesale trade and about 98 percent of all retail trade are socialized. By the mid-1970's Yugoslavia had more than 3200 Western-style self-service markets. Advertising is permitted in print media. Imports in the mid-1970's, comprising chiefly chemicals, machinery and metal products, textiles, and iron and steel, amounted to about \$7.70 billion annually. Exports, including nonferrous metals, machinery and metal products, timber, textiles, and ships, totaled about \$4.06 billion annually. The trade deficit was covered in part by currency earnings from tourism and remittances from Yugoslavs working abroad. The bulk of trade is conducted with West Germany, Italy, the U.S.S.R., and the United States.

Transportation. The transportation facilities of Yugoslavia are underdeveloped in comparison to those of other European countries. In the mid-1970's the railroad system consisted of about 6250 mi. of track, principally between major cities. The railroad network is supplemented by an inland waterway system consisting of some 1265 mi. of river, canal, and lake routes. The highway system includes approximately 45,600 mi. of roads. The number of passenger cars in the country increased from 253,000 in 1966 to 1,537,000 in 1975. In the mid-1970's merchant vessels numbered about 425. The aggregate gross tonnage of all merchant vessels was about 1,900,000. Air service is provided by a

state-owned airline and by a number of international airlines.

Communications. Radio, television, telegraph, and news services are owned and operated by state agencies. In the mid-1970's the country had 186 radio broadcasting systems, some 4,080,000 radios, and about 1,300,000 telephones. There were 9 television stations, more than 450 transmitters and rebroadcast stations, and about 2,780,000 sets. In the mid-1970's 25 daily newspapers, with a circulation of 1,850,000, were published.

Labor. In the early 1970's the working population numbered about 8,890,000, comprising 43.3 percent of the total population. Of this number, about 44 percent were farmers and almost 18 percent were miners and industrial workers. The remainder were workers engaged in building, transport, trade, and services; office employees; technicians; and executives. About 80 percent of all Yugoslav employees belong to unions.

GOVERNMENT

Yugoslavia is a socialist nation governed in accordance with the provisions of the constitution adopted in 1974.

Central Government. Executive power is vested in a president and the federal executive council. The president is head of state and

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commander of the armed forces. By constitutional provision, Marshal Tito (q.v.) was designated president for life. The federal executive council consists of thirty-two members who represent all the republics and provinces. The president of the council is also prime minister. The constitution of 1974 provides that upon Tito's death the presidency shall be a rotating office whose occupant shall be chosen from a nine-member presidential group.

HEALTH AND WELFARE. Compulsory health insurance covers virtually the entire population. Contributions are paid by state enterprises and institutions and by private employers. Self-employed persons pay their own premiums. Insurance covers medical care for illnesses and injuries, sick and maternity leaves, and childbirth. Both health insurance and social insurance are under the jurisdiction, nationally, of the Social Insurance Union, and are administered by social insurance cooperatives throughout the country. Social insurance is obligatory for all employees, and about half the population is covered. Costs are borne by employers, who pay 24 percent of gross payrolls to the Social Insurance Union. Benefits include retirement and disability pensions and funeral expenses.

Legislature. Prior to the constitution of 1974, supreme legislative authority was vested in the Federal Assembly. It was composed of a chamber of nationalities and whichever of four other corporate chambers of the assembly—the economic, the education and culture, the social welfare and health, or the organizational-political chamber—had competence in the specific issues before the assembly. The membership of the chamber of nationalities was 140, with 20 delegates from each of the assemblies of the six republics and 10 from each of the two autonomous provinces. Each of the other chambers had 120 members, those of the organizational-political chamber being elected directly by the people and those of the other chambers being delegated by the communal assemblies.

The 1974 constitution provides for a two-house Federal Assembly. The Federal Chamber has 30 delegates from each of the six republics and 20 from each of the two provinces (all nominated by the Socialist Alliance of the Working People). The Chamber of Republics and Provinces has 12 delegates from each provincial assembly (all to be elected by all chambers of these assemblies sitting in joint session). Delegates to each house of the Federal Assembly are elected for terms of four years and may not represent the same organization or community for more than two consecutive terms.

Political Parties. The Communist Party, called the League of Yugoslav Communists, controls political affairs. Party membership totaled about 1,025,000 in the early 1970's. The party dominates a number of mass organizations, the largest of which is the Socialist Alliance of the Working People of Yugoslavia.

Local Government. The republican, provincial, and communal assemblies are bicameral bodies similar to the federal assembly, but they vary in accordance with local laws and requirements. At each level the assembly is composed of a group of corporate chambers balanced by a republican, provincial, or communal chamber. The people vote directly for the deputies of all the assemblies.

Judiciary. The highest tribunal in the country is the supreme court of Yugoslavia. Lower supreme courts function in each of the constituent republics and in the autonomous province of Vojvodina. Lower courts are the county tribunals and district courts. The bench of the higher courts consists entirely of professional judges. In the lower courts professional judges and laymen, called assessors, sit together.

Defense. Males between the ages of nineteen and twenty-seven, with some exceptions, are required to serve either eighteen months in the army or air force or two years in the navy. The army has a peacetime strength of 220,000 men. The navy numbered 27,000 and the air force 20,000 in the early 1970's. The armed forces can be expanded to 1,250,000 in time of war.

Besides the regular defense forces, three security forces include the people's militia, the administration of state security or secret police, and the secretariat for internal affairs; the last-named comprises individual units organized on the local levels of government.

HISTORY

Political unification and statehood, for centuries common objectives of the south Slavs despite their profound religious and cultural differences, were finally achieved by the Serbs, Croats, and Slovenes in 1918, in the aftermath of World War I. Before the end of the war the lands of the south Slavs, at various times, had been partitioned by neighboring powers, notably Turkey, Italy, Austria, Hungary, and Bulgaria. These partitions ultimately led to the emergence, in the region comprising most of the present-day Yugoslavia, of the independent states of Serbia and Montenegro (qq.v.); of Bosnia and Hercegovina (q.v.), under the sovereignty of Austria-Hungary; of Croatia and Slavonia (see CROATIA), a semiautonomous dependency of Hungary and later an Austrian

crownland; and of Dalmatia, a possession of Austria. The preunification history of the south Slavs is largely contained in the articles cited. *See also* BANAT; CARNIOLA; ISTRIA; MACEDONIA.

The Yugoslav State. Occupation of Serbia by the Central Powers (q.v.) during World War I and the subsequent formation, by south Slavs in exile, of a committee for national unity paved the way for creation of the Yugoslav state. The political principles for unity were enunciated in the Corfu Declaration (see CORFU), which was signed on July 20, 1917, by representatives of the committee and of the Serbian government in exile. Essentially, the declaration provided for the establishment of a federated constitutional monarchy under the Karageorgevich line of Serbian kings.

The disintegration of the dual monarchy of Austria-Hungary (q.v.) in the final months of World War I gave tremendous impetus to the south Slav independence movement. In October, 1918, representatives from the various Slavic dependencies under Austrian and Hungarian sovereignty assembled at Zagreb. After organizing a provisional government, the delegates approved a resolution for union with Serbia. The national assembly of Montenegro took similar action on Nov. 26. Alexander, Prince of Serbia, later Alexander I (q.v.), King of Yugoslavia, pending recovery of his ailing father Peter I Karageorgevich, King of Serbia (see under PETER), accepted the regency of the provisional government on Dec. 1, 1918. Formal creation of the new state, officially styled the Kingdom of Serbs, Croats, and Slovenes, was proclaimed three days later.

Replacement of the provisional government by constitutional authority was delayed for almost two years. Among the primary causes of this interregnum were the uncertainty and confusion attending the delimitation of the frontiers of the new kingdom with Rumania, Austria, Bulgaria, and Hungary. The last boundary problems affecting the Slavs and these states were disposed of in June, 1920; see SAINT GERMAIN, TREATY OF; TRIANON, TREATY OF. As a result of Italian demands for Slav territory, the Paris Peace Conference had meanwhile become deadlocked on the question of the western frontiers of the new kingdom. On Sept. 12, 1919, during the deadlock, Fiume (see RIJEKA), one of the principal disputed areas, was seized by a quasi-official force of Italian troops under the author and nationalist leader Gabriele D'Annunzio (q.v.). This action and pressure from other Allied powers finally led to direct negotiations between the Italian and provisional Slav governments. With

the signing, on Nov. 12, 1920, of the Treaty of Rapallo by Italy and Yugoslavia, the two nations reached an amicable settlement. Mainly in exchange for renunciation of its claims on Dalmatia, Italy obtained Istria and other important territorial concessions. The treaty also provided for establishment of Fiume as a free city under the administrative control of the League of Nations. This provision did not go into effect, however, and Italy, in 1924, secured formal Yugoslav recognition of its de facto ownership of the port.

In November, 1920, with all major boundary disputes disposed of, the provisional government held elections for a constituent assembly. Despite the bitter opposition of the Croats, who favored federalist constitutional principles, a conservative coalition in the assembly voted approval in January, 1921, of a constitution providing for a highly centralized form of government. Peter I of Serbia died on Aug. 16, 1921, and on that date his son became king as Alexander I. **The Reign of Alexander.** Serbian domination of the government, a multiplicity of political parties, and denial of autonomy to the Croats, Slovenes, and other minority groups engendered intense political strife in the kingdom. Under the guidance of Stephan Radić (1871–1928), the Croats and their allies systematically struggled against the centralist system and leadership. The first phase of the struggle ended when, on June 20, 1928, a Montenegrin deputy in the national parliament shot and fatally wounded Radić and several of his parliamentary colleagues. In retaliation, the Croat caucus withdrew from the parliament and organized a separatist regime, with headquarters at Zagreb. Civil war seemed imminent, but on Jan. 6, 1929, King Alexander suspended the constitution of 1921, dissolved parliament and all political parties, and assumed dictatorial control of the government. The king subsequently abolished the traditional administrative designations and divisions of the kingdom, which was renamed the Kingdom of Yugoslavia.

Although the dictatorship rigorously suppressed all opposition to its program, manifestations of popular discontent became increasingly frequent throughout the kingdom. Mounting internal discord finally compelled King Alexander to grant certain reforms. On Sept. 3, 1931, he proclaimed termination of the dictatorship and promulgated a new constitution. While providing for limited parliamentary government, the constitution contained restrictive measures designed to perpetuate domination of the government by the king. A majority of the opposition groups in Yugoslavia consequently boycotted

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the ensuing parliamentary elections, inaugurating a new stage in the fight against the centralist regime. On April 29, 1933, Vladko Maček (1879–1964), who had succeeded Stephan Radić as head of the Croat movement, was convicted of treasonable activity and sentenced to three years in jail. Royal intransigence on the question of national minorities served merely to strengthen the opposition, which included various extremist groupings. On Oct. 9, 1934, King Alexander, then in France on a diplomatic mission was assassinated by a Croat terrorist group. The king's son, still a minor, succeeded to the Yugoslav throne as Peter II (see *under* PETER). Control of the government was vested in a three-man regency council headed by Prince Paul (1893–1976), a cousin of the late king.

The death of Alexander brought no appreciable change in the domestic policy of the Yugoslav government, but the event foreshadowed fundamental shifts in the realm of foreign affairs. Under Alexander's direction, Yugoslav foreign policy had consistently sought the creation of close and friendly relations with neighboring nations. Formation, in 1921, of the Little Entente (q.v.), a Czechoslovak-Rumanian-Yugoslav alliance aimed primarily at discouraging the resurgence of German power in Europe, had led to similar pacts with other nations. In June, 1934, Alexander, reflecting the uneasiness prevalent in Europe after the victory of National Socialism in Germany, had signed a trade agreement with the Third Reich.

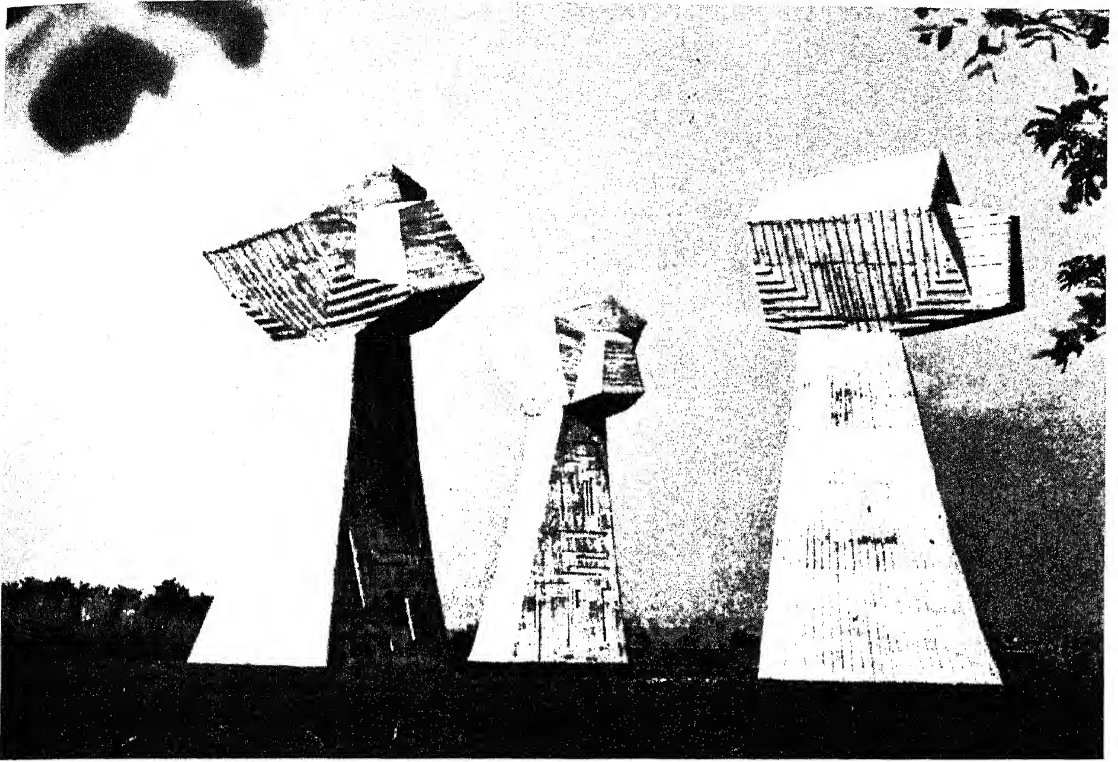
World War II. Conclusion of a more liberal commercial agreement with the Third Reich in May, 1936, signalized adjustment of Yugoslav foreign policy to the rapidly changing diplomatic situation in Europe. A Yugoslav-Bulgarian treaty of friendship was arranged in January, 1937, and in the following March the Yugoslav and Italian governments concluded a non-aggression pact, implicitly heralding Yugoslav adherence to the German-Italian coalition known as the Axis powers (q.v.). This move, which served to deepen popular discontent with the regency, was followed in July, 1937, by a concordat with the Vatican. The concordat alienated the Orthodox Church.

In October, 1937, the leaders of the Croatian and Serbian movements for a democratic government announced a program of joint action for common demands. German absorption of Czechoslovakia in 1938 deepened popular antipathy in Yugoslavia for the regency's policy of friendship with the Axis powers. By the spring of 1939 the Yugoslav government had been compelled to initiate negotiations with the op-

position on the question of transforming the nation into a federal state. These negotiations resulted, on Aug. 26, 1939, in a large degree of autonomy for Croatia, plans for the reorganization of the rest of the country along federalist lines, and substantial democratization of the government. Vladko Maček, who had been released from prison shortly after Alexander's assassination, was appointed vice-premier.

The Yugoslav government proclaimed neutrality following the German invasion of Poland on Sept. 1, 1939. As the ensuing conflict gathered momentum, however, Yugoslavia was forced into closer alignment with the Axis powers by its close economic ties with Germany, the presence of National Socialist sympathizers in leading government circles, and relentless pressure from the Axis powers for a formal alliance; see *WORLD WAR II*. In the winter of 1940–41 the Axis position in the Balkans was gravely endangered by Italian reverses at the hands of the Greeks, making such an alliance imperative from the German viewpoint. Bulgarian capitulation, on March 1, 1941, to German demands that the country adhere to the Tripartite Pact of 1940 between Germany, Italy, and Japan marked the beginning of a German diplomatic offensive against Yugoslavia. On March 22, following an ultimatum from the Third Reich, the Yugoslav government also capitulated and signed the pact. Popular indignation culminated two days later in a successful coup d'état. The regency was deposed, and with King Peter's backing the insurgents formed a government dedicated to the maintenance of neutrality. The governments of the United States and Great Britain soon proclaimed support of the Yugoslav stand, and the Soviet Union, on April 5, concluded a nonaggression pact with the new government.

THE OCCUPATION. Axis retribution was swift and merciless. Supported by Italian, Hungarian, and Bulgarian forces, German armies invaded Yugoslavia on April 6. King Peter and the government fled on April 12, and one week later the high command of the overwhelmingly outnumbered Yugoslav army surrendered. Retaining their arms, tens of thousands of Yugoslav troops went into hiding. The vanquished kingdom was speedily dismembered. Italy took the Dalmatian region, part of Slovenia, and Montenegro. Germany took the remainder of Slovenia. Serbia was also taken by the Germans, who granted nominal control of most of the region to a puppet government. Hungary seized Vojvodina, and Bulgaria seized most of Macedonia. A puppet state, headed by native nationalists and



under Italian protection, was formed in Croatia, which received Bosnia.

For more than two years after the partition of Yugoslavia, great political and military turmoil prevailed in the country. Under General Draža Mihajlović (1893?–1946) the Serbian nationalists, called Chetniks, waged guerrilla warfare against the Croatian puppet state and its foreign protectors; see GUERRILLAS. Nationalist Croats retaliated with a campaign of extermination against the Serbs. Other guerrilla detachments, led by Josip Broz, a Croatian Communist, better known as Tito, campaigned against the invaders and the puppet forces. The Yugoslav government in exile recognized Mihajlović as commander in chief of the national resistance contingents, in December, 1941, further complicating domestic politics. In 1942 Tito's partisans, having won de facto control of part of Bosnia, founded a provisional government. This government, the Council for National Liberation, later accused the Chetniks of collaboration with the enemy. Armed clashes between the two factions occurred frequently thereafter.

The Council for National Liberation extended its military operations in Yugoslavia throughout 1943, building up an army of more than 200,000 men and conquering over 40,000 sq.mi. of Yugoslav territory. British and American military

Modernistic concrete monuments near Niš honor the partisans of World War II who fought in the hills of Yugoslavia.
UPI

missions joined the Liberation Army in late 1943. In December, the Council, refusing to recognize the authority of the government in exile, established a national parliament. The rupture between the royal and provisional governments was healed, mainly through British mediation, in the summer of 1944. By the terms of the settlement, the provisional regime received representation in the government in exile and Tito, who had been elevated to the rank of marshal, replaced Mihajlović as the official head of the Yugoslav army. In October, 1944, Allied armies, operating in conjunction with Tito's forces, launched an offensive against the German army of occupation in Yugoslavia. German troops were cleared from Belgrade and most of their other Yugoslav strongholds before the end of the month.

The Postwar Government. On Nov. 24, 1944, following various conferences in Moscow among representatives of the Soviet, British, and the two Yugoslav governments, plans were announced for the merger of the royal Yugoslav government and the Council for National Liberation. Features of the projected regime included local autonomy for the various ethnic groups

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and a regency council, which would exercise King Peter's powers pending determination by plebiscite of his status. These plans were approved by the U.S., Great Britain, and the Soviet Union at the Yalta Conference (q.v.) in February, 1945. A new government was formed on March 7, 1945, with Marshal Tito as premier and with Communists in other key positions; it promulgated a program of generally mild social and economic reforms. On June 26, 1945, Yugoslavia became a charter member of the United Nations.

Elections for a constituent assembly were held on Nov. 11, 1945. Moderate political groups, officially prohibited from running candidates, boycotted the polls. The candidates of the Communist-led United National Front secured the endorsement of 80 percent of the eligible electorate. On Nov. 28 the newly elected constituent assembly, regarding the vote as a mandate against the monarchy, proclaimed the Federal People's Republic of Yugoslavia. The U.S., British, and Soviet governments recognized the republic in the course of the next few weeks. Following adoption of a new constitution on Jan. 31, 1946, the constituent assembly reconstituted itself the national parliament. A new cabinet, with Marshal Tito as premier and with substantially increased Communist representation, was formed on Feb. 1.

In 1946 the Tito government nationalized various sectors of the economy, imposed restrictions on the Roman Catholic Church, and liquidated uncooperative opposition groups. Newspapers critical of the policies of the Tito government were suppressed. Labor unions became semiofficial arms of the government. The Chetnik leader Draža Mihajlović was captured and indicted for treason and collaboration with the enemy. He and eight other Chetnik leaders were convicted and executed in July. On Sept. 23 Archbishop Aloysius Stepinac (1898–1960), Roman Catholic primate of Yugoslavia, was tried on charges of treason and, on Oct. 11, was sentenced to life imprisonment.

In 1947 purge of political opponents was intensified, as was the tempo of agrarian and other economic reforms. A five-year plan for the industrialization and electrification of the country was promulgated.

Unlike the Soviet Union or other Communist countries, postwar Yugoslavia has had only one dominant political figure. In the early years Tito strengthened his position by severe purges of political, economic, and educational leaders who opposed his policies. A new constitution promulgated in 1953 provided for the election

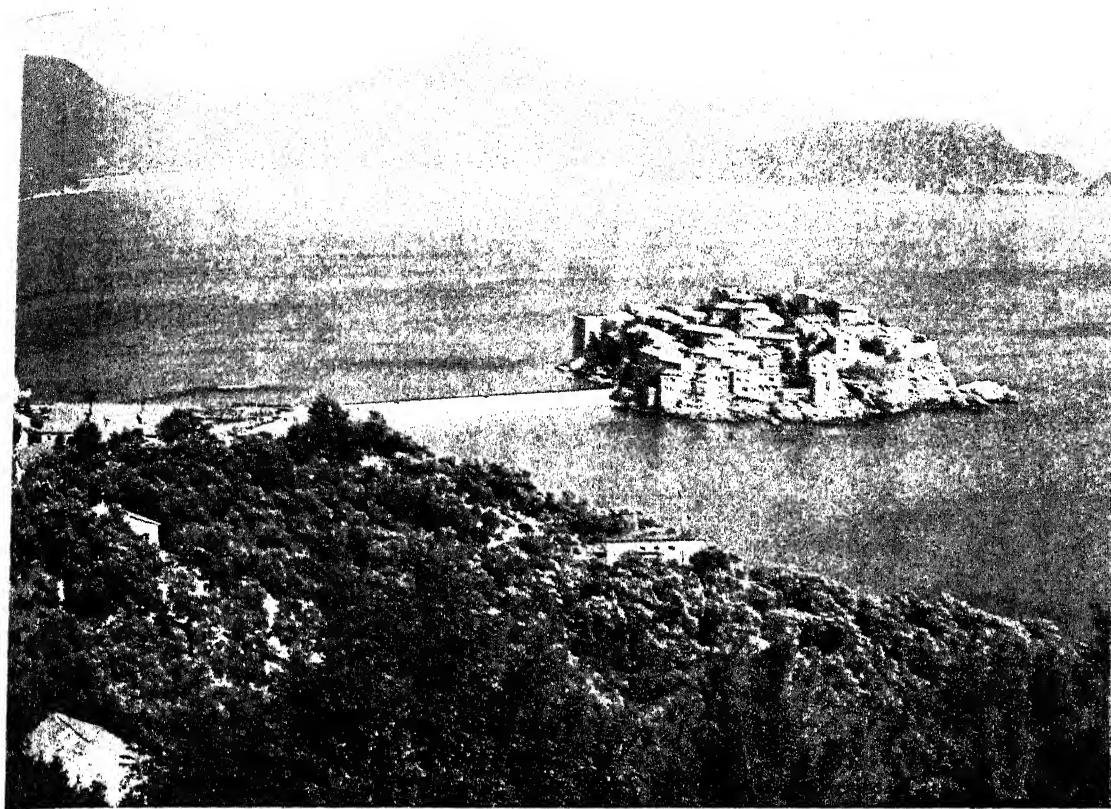
of a president by the federal assembly, which promptly reelected Tito. In the November, 1953, election the secret ballot was used for the first time. In this election and in the election in 1958 opposition candidates were elected.

Governmental Reorganization. A new constitution, on which a committee headed by Vice-President Eduard Kardelj (1910–79) had worked for two years, was presented in 1962 and adopted by the federal assembly in 1963. It changed the name of the country to the Socialist Federal Republic of Yugoslavia and declared self-government for all the people. Opposition candidates ran in one fourth of the contests for the local assemblies in 1963 elections. In 1965 several candidates ran in about half of the election districts. By that time the federal assembly had assumed a greater role and insisted on thirteen redrafts of the budget. In 1966 the party central committee was temporarily reorganized, without diminishing the power of Tito or of the Socialist Alliance, which includes and is dominated by the League of Communists. Plans were announced in 1967 by which the central government would share more of its powers with the six republics.

Political Purges. Several possible successors of Tito have been removed from the political scene. Aleksandar Ranković (1909–), vice-president in 1966, was suddenly dismissed and accused of both interfering with the new economic plans and of using the secret police for intervention in party affairs. Secret Police Chief Svetislav Stefanović (1910–), was also dismissed, as were hundreds of Ranković's subordinates, while many of his opponents were reinstated. In addition, many writers were punished; most notable among them was Milovan Djilas, who criticized various governmental activities in both the U.S.S.R. and Yugoslavia. After serving several sentences, beginning in 1955, he was released in 1966, but was prohibited from public speaking or writing for five years.

Tito also had difficulty with the Croats, who resented Serb domination. Many Croatian scholars insisted on recognition of a separate Croat language. Croat is so similar to the Serb that the languages are called, collectively, Serbo-Croatian. Mihajlo Mihajlov, formerly on the faculty of a university at Zadar in Croatia, and students who favored a Croatian liberal movement and complained that economic reforms favored the Serbs were imprisoned.

Religious difficulties continued into the 1960's. Archbishop Stepinac, Roman Catholic Primate of Yugoslavia, was released from prison in 1951, but confined to the village of Krašić; in



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Yugoslavia. Plate 1. Since Roman times, the Adriatic Coast and its picturesque islands have comprised a popular resort region. Above: The tiny island village of Sveti Stefan boasts a wonderful beach and its past as a pirates' stronghold. It is connected with the mainland by means of a narrow causeway. Below: The ancient resort city of Split, a commercial and industrial center, was founded late in the 3rd century A.D.



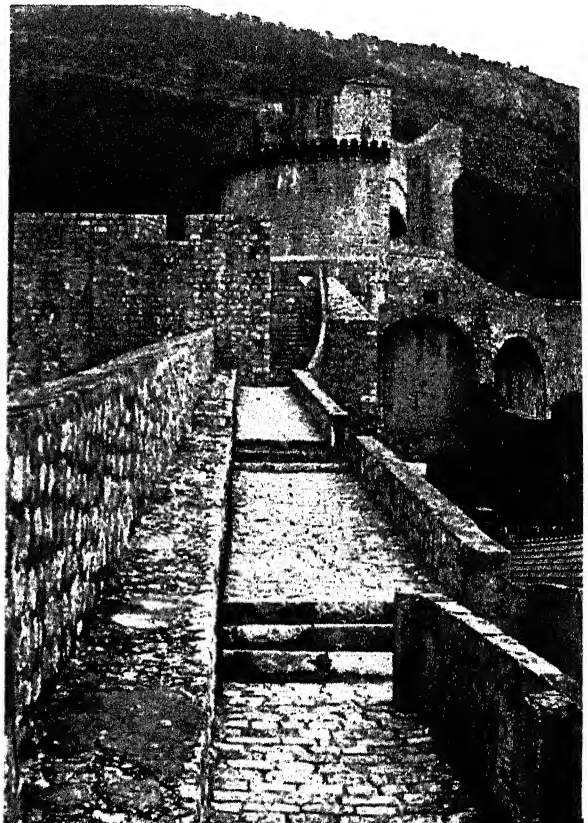
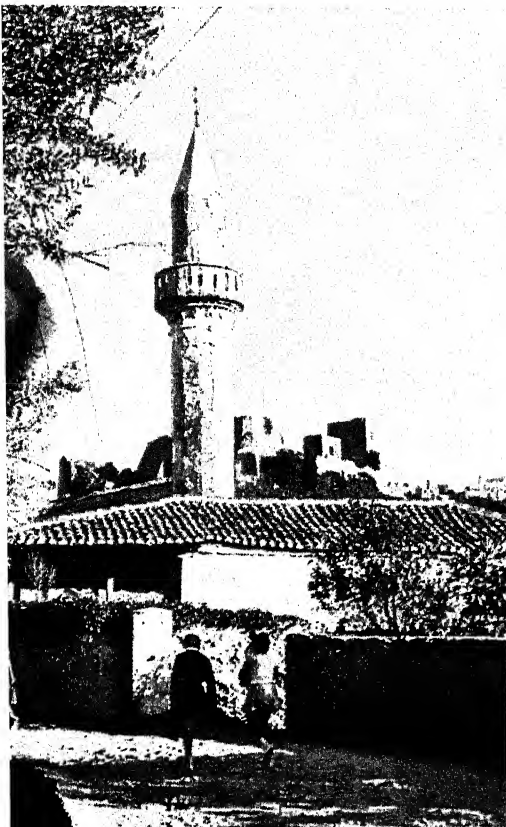


Richard Wilkie - FPG

Yugoslavia. Plate 2. Above: Neighbors chat at a rural fair in a village on the Danube River. Below, left: Ancient ruins crown a hill above Ulcinj, a shallow-water seaport on the Adriatic coast near the Albanian border. Below, right: The fortifications of the walled city of Dubrovnik founded in the 7th century. In the Middle Ages the city was a center of Serbo-Croatian culture, and is today noted for sports and cultural activities.

Yugoslav Information Center

Harvey Stein



1953 he was designated a cardinal by Pope Pius XII (see under Pius). The Vatican and Yugoslavia, following disagreements, broke relations in 1953 and did not resume them until 1966. In 1960, however, when Stepinac died, the government permitted his burial in the Zagreb cathedral.

Agriculture and Industrial Expansion. Since the end of World War II agriculture has been a persistent problem to the Yugoslav government. Intermittent and serious food shortages have necessitated grain shipments from both the U.S. and the U.S.S.R. The shortages resulted from severe droughts, and from conflict between the peasants and government over collectivization. The government has been attempting to form large collective farms since immediately after the war, and in 1953 the maximum size of private holdings was reduced to 25 acres. The Party Congress in 1959 again called for reorganization of agricultural land into larger socialized units, but collectivization was never forced, and at no time was more than about 13 percent of the land collectivized. About 70 percent of the private farms were smaller than 13 acres and were poorly cultivated. Most of the food for the cities came from the socialized farms.

The government has been much more interested in developing industry than land. Postwar spending to rebuild and modernize industry averaged about \$1,000,000,000 annually. The five-year plans generally emphasized development of heavy industry at the expense of consumer goods industries and agriculture. In the late 1950's, economic controls were decentralized and greater responsibilities were assigned to the trade unions, which already had more power than in other Communist states.

In 1965 and 1966 further economic reforms produced what has been called an economic revolution. The relatively small amount of control held by the central government was decreased, and more responsibility was assigned to the individual enterprises and to the workers' unions. Unsubsidized competition among enterprises was called for.

Total industrial production in 1957 had increased by 70 percent over that of 1953, and by 1966 had more than doubled the 1957 figure. In addition, the portion of the gross national income accumulated and distributed by the central government was rapidly being cut from 70 percent to 30 percent. By 1967 prices had been stabilized, savings were increasing steadily, and labor productivity had risen by about 7 percent. In the 1960's the government abolished visa requirements and attempted to reduce the persistent unfavorable balance of trade by attracting

tourists to the Dalmatian coast. Hotels and restaurants, many privately owned, increased.

Relations with the U.S.S.R. As the so-called cold war began between the Communist and the Western countries, Yugoslavia was allied with the U.S.S.R. and rejected participation in the U.S.-sponsored European Recovery Plan. In 1947 Yugoslavia joined the Communist nations in establishing the Communist Information Bureau (Cominform), which succeeded the Third International (q.v.), dissolved in 1943. Headquarters of the new organization was in Belgrade. Early in 1948, however, Tito refused to accept orders from Soviet Premier Joseph Stalin (q.v.), and the U.S.S.R., through Cominform, retaliated. In a meeting in Bucharest in June, which Yugoslavia boycotted, Cominform denounced Tito and the Yugoslav Communist Party, accusing them of major deviations from orthodox Communist policy. A Yugoslav party congress reaffirmed its loyalty to the U.S.S.R., but reelected Tito, whom the Soviet leaders had hoped to overthrow. The success of Yugoslavian national Communism hampered Soviet efforts to control the Communist bloc and set a precedent for independence followed in some degree by other Communist countries.

The Soviet-Yugoslav struggle became sharper in 1949, as the U.S.S.R. and other Communist states denounced treaties of friendship with Yugoslavia, and banned the country from membership in the newly formed Council for Mutual Economic Assistance (q.v., COMECON). In the Korean fighting in 1950 to 1953, Yugoslavia, in contrast with all other Communist states, joined in the U.N. embargo on furnishing arms to North Korea and Communist China. In 1953 Yugoslavia joined Greece and Turkey in treaties of mutual assistance to form a Balkan Entente, which declined as relations between the Communist nations improved.

Shortly after the death of Stalin in 1953 the Soviet Union, followed by the other Communist states, resumed diplomatic relations with Yugoslavia, but Yugoslavia did not rejoin Cominform or enter COMECON. In 1954 Yugoslavia participated in the Soviet anniversary celebrations in Moscow, and Soviet leaders joined in the Yugoslav celebration of the tenth anniversary of the Russian rescue of Belgrade from the Germans. Along with professions of mutual friendship, however, Tito stressed Yugoslav obligations to the West. The visit of Soviet Premier Nikita S. Khrushchev (q.v.) to Belgrade in 1956 was followed by an agreement on cultural exchanges, a Soviet loan of \$84,000,000, and the cancellation of Yugoslavia's debt of \$90,000,000.

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In the next few years Yugoslav relations with the Soviet Union vacillated. Khrushchev and Tito exchanged cordial visits in 1956; however, early in 1957, at the 40th Soviet anniversary celebrations, Yugoslavia joined other Communist states in a peace manifesto, but did not participate in their declaration of solidarity. In 1958 trade declined, and in 1962 cordial reciprocal visits were resumed, with Tito addressing the Supreme Soviet in Moscow. By 1963 trade with the Soviet Union and other Communist states was increasing, but 70 percent of Yugoslav trade was with the West and neutral countries. In 1964 Yugoslavia became an affiliate member of COMECON and participated in its commissions on trade, metallurgy, and chemicals. In addition, Yugoslavia agreed to cooperate with Rumania in constructing a great navigation and hydroelectric project at the Iron Gate on the Danube R. On the other hand, by the 1960's Yugoslav ties with the West had caused bitter relations with Communist China and Albania.

Developing Relations with the West. Since World War II, Yugoslav relations with the West have generally improved. In 1949 Yugoslavia secured financial help from the U.S. Export-Import Bank and from the International Bank for Reconstruction and Development (q.v.; I.B.R.D.), and signed a trade treaty with Great Britain. In the same year Yugoslavia was elected to the U.N. Security Council, against bitter Communist opposition. The U.S. continued to furnish aid, particularly in years of grain shortages, and by 1952 was also furnishing military supplies.

From the end of the war until 1954 Yugoslavia was greatly interested in Trieste (q.v.), where Tito's forces had joined those of the U.S. and Great Britain in 1945 to drive out the Germans. By the Italian peace treaty in 1947 a free territory was set up under the U.N., with the U.S. and Britain administering a zone, including the city of Trieste, and Yugoslavia administering a smaller zone. After long controversy, a settlement in 1954 gave Yugoslavia Zone B and some rights in the city of Trieste.

Extensive financial aid to Yugoslavia from the U.S., Great Britain, the I.B.R.D., and the International Monetary Fund (q.v.) continued into the 1960's. In 1964 Yugoslavia became the first Communist country to participate in the Fulbright exchange program with the U.S.

Tito and the Nonaligned Nations. In 1954, Tito took the first step in what he probably regards his greatest role—forming a neutral or nonaligned group of nations. His first trip to the Republic of India was followed by another in 1955, and a return visit by the Indian prime min-



President Tito of Yugoslavia.

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ister Jawaharlal Nehru (q.v.). In 1956 Nehru and President Gamal Abdel Nasser (q.v.) of Egypt visited Tito at his Brioni resort. In 1961 Tito arranged a conference of nonaligned states in Belgrade, with twenty-one African and Asian states and Cuba in attendance. Tito maintained his friendship with Nehru's successors, Lal Bahadur Shastri (1904–66) and Indira Gandhi (q.v.), and President Gamal Abdel Nasser (q.v.) of Egypt, and these three nations emerged as leaders of the nonaligned group.

In the U.N., Yugoslavia generally voted with the Communist states, but, as noted above, deserted them on the Korean issue, and also voted for the enlargement of the Security Council and the Economic and Social Council, which the Soviet Union opposed. Yugoslavia has also continued payment of all dues and assessments. The attitude of Yugoslavia toward the occupation of Czechoslovakia by Warsaw Pact armies in 1968 was one of outright condemnation.

The late 1960's and early 1970's were marked by improved Yugoslav relations with other countries, regardless of their political orientation. In 1971 Tito and Soviet Communist leader Leonid I. Brezhnev (q.v.) met in Belgrade and signed a declaration reaffirming Yugoslavia's political independence but calling for strength-

ening of ties between the two nations. That policy was reflected by subsequent friendly Soviet-Yugoslav visits and by Tito's cultivation of good relations with the European Common Market, the U.S., and China. Yugoslav independence was also expressed by Tito's visits to India, Egypt, and other nonaligned nations before he attended their conference in Sri Lanka in 1976.

Internal Affairs. In the 1970's the Yugoslav economy suffered from inflation, unemployment, strikes, and, usually, a huge foreign trade deficit, despite devaluation of the dinar and commercial agreements with both East and West. Tension between Croats and Serbs, exacerbated by riots, hijacking, and assassination, evoked severe repression. Thousands of Croats and others accused of subversive nationalism, liberalism, or pro-Soviet leanings were purged from the party, fired, or imprisoned. Although the constitutional amendments of 1971 and the new constitution of 1974 gave more power to regional units and workers' assemblies, and hundreds of prisoners received amnesty in 1977, Yugoslavia remained a one-party state. After Tito's death in 1980, the first man to serve as president for a full term was Cvijetin Mijatović (1913–) of Bosnia-Herzegovina.

YUKAWA, Hideki (1907–), Japanese physicist, born in Tokyo, and educated at the universities of Kyoto and Osaka. He became a lecturer in physics at Kyoto University in 1932 and was made professor in 1939. Yukawa also taught at Osaka University from 1933 to 1936 and was assistant professor there until 1939. He was visiting professor at the Institute for Advanced Studies at Princeton, N.J., in 1948 and at Columbia University from 1949 to 1953. Yukawa became professor emeritus at Osaka University in 1950 and was named director of the Research Institute for Fundamental Physics at Kyoto University in 1953. Yukawa did extensive research into quantum mechanics (q.v.) and the fields of force affecting elementary nuclear particles. In 1935 he theoretically deduced the existence of the subatomic particle meson (q.v.), for which he was awarded the 1949 Nobel Prize in physics. The existence of the meson was proved in 1936.

YUKON, river of N.W. North America, 3186 km (1979 mi.) long. The river, which has a drainage basin of more than 854,000 sq.km (329,729 sq.mi.), rises in Tagish, Atlin, and Teslin lakes, which straddle the border between British Columbia and Yukon Territory, Canada; its ultimate source is the Nisutlin R., a tributary of Teslin Lake. The Yukon initially flows N.W., in Yukon Territory, past Whitehorse, Carmacks, Fort Selkirk, and Dawson; its main tributaries in

this section are the Big Salmon, Pelly, White, Stewart, and Klondike rivers. The Yukon then enters Alaska, where it flows W. across the State for 2037 km (1265 mi.) before emptying through a large delta into the Bering Sea. The chief affluents in Alaska are the Porcupine, Tanana, and Koyukuk rivers. After receiving the Porcupine, the Yukon flows in many channels for about 240 km (149 mi.) through the Yukon Flats, a region of sandbars and low-lying wooded islands.

The Yukon is navigable by shallow-draft commercial vessels as far upstream as Whitehorse. It was an important transportation route in the late 19th and early 20th centuries, but now is used principally by local traffic.

YUKON TERRITORY, administrative region of Canada, bounded on the N. by the Beaufort Sea, on the E. by the Northwest Territories, on the S. by British Columbia, and on the S.W. and W. by Alaska. The area of the territory is 207,076 sq.mi., including 1730 sq.mi. of water surface; it comprises 5.4 percent of the total area of Canada.

THE LAND

The Yukon Territory lies in the Cordilleran region of the North American continent. Its chief physical feature is a high, central plateau trending in a N.W. to S.E. direction and with an average elevation of 2000 to 3000 ft. above sea level. Along the borders of the territory the plateau is dissected by vast mountain ranges, particularly in the extreme S.W., where, in the Saint Elias Mts., Mt. Logan (19,850 ft.), Mt. Saint Elias (18,008 ft.), and Lucania Mt. (17,147 ft.), the highest peaks of Canada, are situated. Ranges of the Rocky Mountains (q.v.) project into the N.E. part of the territory. The territory abounds in caribou, moose, bear, mountain sheep, and other wild game. In the S.W. are large forests.

Rivers and Lakes. The S. part of the territory is drained by the Yukon River (q.v.) and its tributaries and by the Liard R. in the S.E.; the Peel R., a tributary of the Mackenzie R., and the Porcupine R., a tributary of the Yukon R., drain most of the N. part. Among the larger lakes are the Kluane, Teslin, Aishihik, and Laberge.

Climate. Continental climatic conditions prevail in the Yukon. The winters are long and severely cold, and the summers are short and warm. Snag, near the Alaska border, has the lowest recorded temperature in North America at -81° F., and the highest temperature on record in the territory is 95° F. at Dawson and Mayo. At Dawson, in the W. central part of the territory, temperatures average about -20° F. in January and about 60° F. in July. Precipitation in the territory ranges between 10 and 17 in. yearly, about half rain and half snow.

YUKON TERRITORY



THE PEOPLE

The population of the Yukon Territory, according to the latest official census (1976), was 21,836. Almost 39 percent of the population is rural, and the remaining 61 percent lives in the capital, Whitehorse (q.v.).

About 78 percent is of European birth or descent, concentrated chiefly in towns and villages. Native Indians, comprising the rest of the population, are scattered throughout the territory.

Education and Cultural Facilities. Education is nonsectarian and free and is administered by the territorial government. The Federal govern-

The town of Whitehorse, on the banks of the Yukon River, is the capital of Yukon Territory.

National Film Board of Canada

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Porcupine (riv.)	B 1
Richardson (mts.)	B 1
Saint Elias (mt.)	A 2
Saint Elias (mts.)	B 2
Selous (mt.)	C 2
Selwyn (mts.)	C 2
Stewart (riv.)	B 2
Teslin (riv.)	C 2
White (riv.)	A 2
Yukon (riv.)	A 1, B 2

ment is responsible for the education of Indians although they attend the publicly controlled schools. Attendance is compulsory for children between the ages of six and sixteen.

In the late 1970's, 5462 students annually attended 23 elementary and secondary schools. Full-time teachers numbered 280. While there are no postsecondary academic institutions in the territory, financial assistance is provided for higher education outside the Yukon. There is a technical training center for advanced vocational study. The public library in Whitehorse

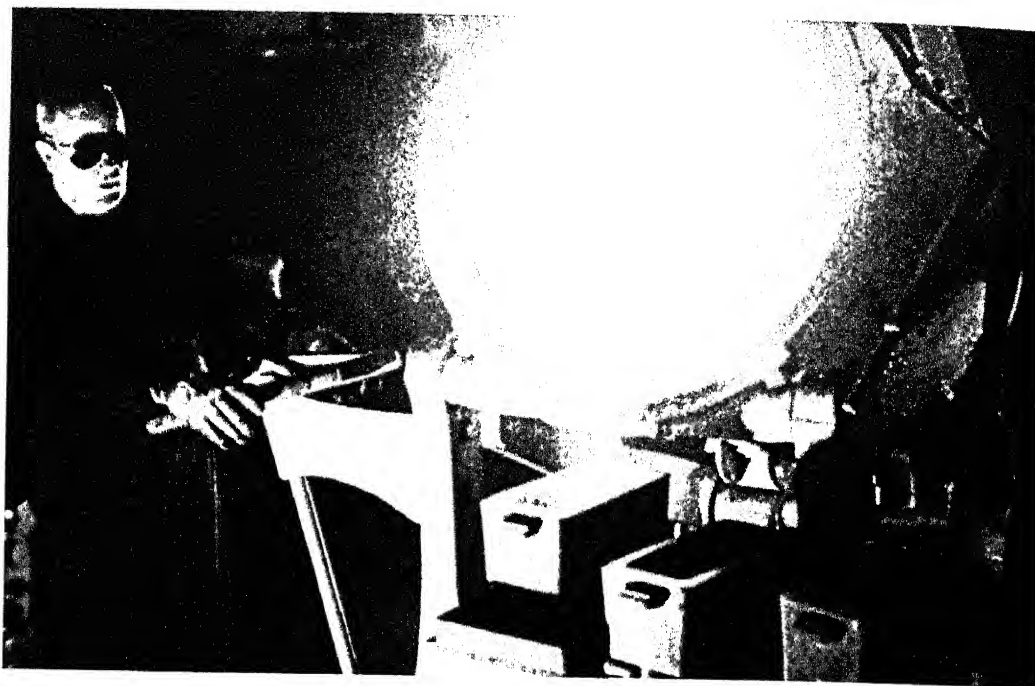




Yukon Territory. Plate 1. Above: A vista of mountain crags, part of the Cordilleran chain that forms the principal mountain axis of the North American continent. Below: Despite the short growing season, farms are productive along the rivers of the Yukon Territory.

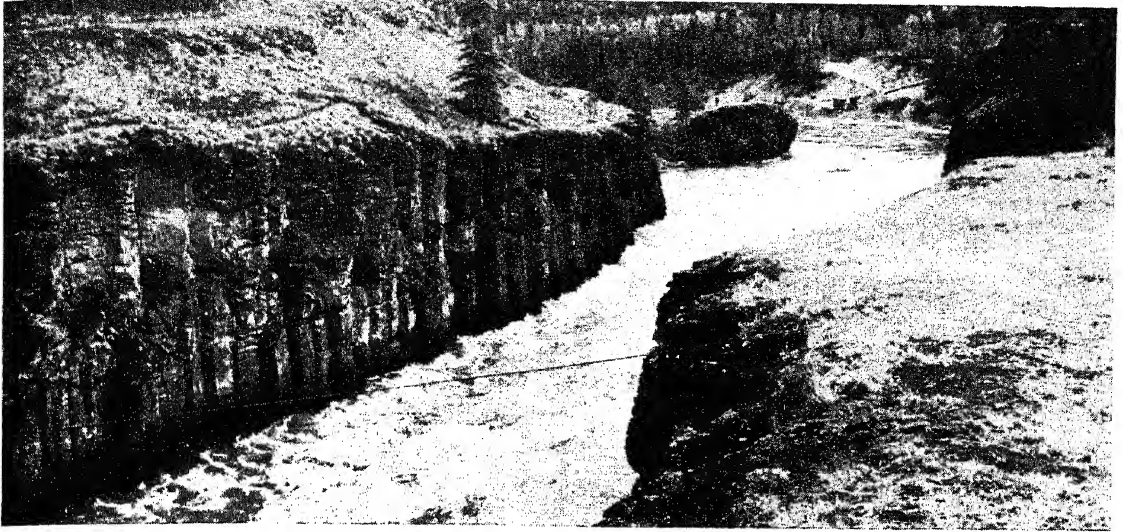
Pictures Plates 1 and 2. Canadian Consulate





***Yukon Territory. Plate 2.** Above: Silver is cast into ingots; the precious metal is among the major products of the Yukon mining industry. Below: Despite vast areas of forest land, lumbering in the Yukon is not a major industry, a result of limited transportation facilities caused by the territory's land formation. Most of the wood is used for domestic purposes.*





Miles Canyon near Whitehorse reveals some of the rugged beauty for which the Yukon is known.

National Film Board of Canada

maintains seven branch libraries throughout the territory.

Historic sites within the Yukon are reminders of the Klondike (q.v.) gold rush days. Several buildings in Dawson (q.v.), including the Palace Grand Theatre, the post office, and a cabin where Robert Service (q.v.) lived, are now being restored. Also of interest is Kluane National Park in the s.w. Yukon, which includes the highest mountains in Canada, extensive ice fields and glaciers, and abundant wildlife.

THE ECONOMY

Mining is the principal industry of the Yukon, which is rich in mineral resources. Production was valued at over \$200,000,000 annually in the late 1970's. Zinc, lead, silver, copper, and asbestos account for 98 percent of the total. Cadmium, gold, nickel, uranium, tungsten, and iron ore are also mined.

While thermal electric generation still provided electricity for several communities in the late 1970's, hydroelectric generation was the main source of power.

Higher world prices for furs encouraged a revival of fur trapping; pelts, mainly beaver, lynx, muskrat, marten, and squirrel, were valued at about \$360,000 annually in the late 1970's.

Some small-scale feed and livestock farming, generally for personal consumption, is carried on. Lumbering is also on a small scale, despite the Yukon's 25,000,000 acres of potentially productive forest with estimated timber reserves of 6 billion cu.ft.

Tourism. Tourism ranks as the second largest industry. In the mid-1970's the territory was visited each year by more than 300,000 persons,

spending in excess of \$25,000,000. The main attractions, in addition to the historic sites in Dawson and the Klondike gold fields, are the unspoiled wilderness areas and lakes, with opportunities for big game hunting and fishing, the "Trail of '98", and the Alaska Highway (q.v.).

Transportation and Communications. The Yukon has 58 mi. of railroad track and 2600 mi. of roads. The Alaska Highway is the main artery through the southern half of the territory. Other roads provide access to the interior, formerly reached only by river. In addition, there is regularly scheduled air service to points in southern Canada and between Whitehorse and Fairbanks, Alaska.

The Yukon receives radio and television programs provided by the Northern Service of the Canadian Broadcasting Corporation and live television through the Anik communications satellite.

GOVERNMENT

The Yukon was created as a separate territory in 1898. Territorial government is administered by a commissioner appointed by the governor-general of Canada and responsible to the minister of Indian affairs and northern development. He is assisted by an executive committee of two members appointed from the Federal government and three from the elected legislative assembly. This assembly consists of twelve members elected at large. The commissioner abides by most financial measures and legislation passed by the assembly. All Canadian citizens eighteen years of age and older are eligible to

YUMA

vote in both territorial and Federal elections. The Yukon is represented in the Canadian parliament by one member each in the House of Commons and the Senate.

The Yukon Act provides for the local administration of all matters of a regional nature and for the administration of justice, but the court of appeals is headed by the chief justice of British Columbia.

HISTORY

The modern history of the Yukon dates from 1825 when Sir John Franklin (q.v.) visited the N. coast. The Hudson's Bay Company (q.v.) established trading posts along the Yukon R. in the 1840's, and discoveries of gold in creeks and rivers began to be reported in the 1860's. The region remained virtually uninhabited, however, until 1896, the year of the Klondike gold strike. Two years later, at the peak of the gold rush, the population of Dawson alone was over 40,000. Some \$100,000,000 worth of gold was discovered in the region between 1896 and 1904.

With the subsequent exhaustion of rich placer deposits, the population began to decline; by 1921 there were only 4157 persons in the territory and 4914 in 1941. The population began to rise during World War II with the construction of a section of the Alaska Highway, followed—in the 1950's—by the setting up of Distant Early Warning (DEW) line radar stations; see COAST DEFENSE. Since 1960, with the resurgence of mining, the population has continued to increase, more rapidly than in the nation as a whole. Between 1971 and 1976 the growth rate was 18 percent, compared to 5 percent for the rest of Canada.

Current problems in the Yukon include the settlement of Indian land claims and an increasing demand for more local control of government. New development projects promise to alter radically the life-style of the territory. Under consideration in the late 1970's were the construction of a natural gas pipeline and an aluminum smelter in Whitehorse, further development of hydroelectric power, exploitation of lead-zinc and tungsten resources, and improvement of transportation facilities.

STATISTICS CANADA

YUMA, city in Arizona, and county seat of Yuma Co., at the confluence of the Colorado and Gila rivers, about 155 miles s.w. of Phoenix. The city is served by railroad. Industrial establishments in Yuma are railroad shops, food-processing plants, and factories producing clothing. Points of interest in the city include one of the first stores built there and ruins of a territorial prison. The Spanish visited the site of the pres-

ent-day city about 1540. The town was laid out in 1854 and named Colorado City. After gold was discovered in the area in 1858, the town rapidly expanded and in 1870 it was made the county seat. Yuma was incorporated as a city in 1914. Pop. (1960) 23,974; (1970) 29,007.

YUMAN. See AMERICAN INDIAN LANGUAGES.

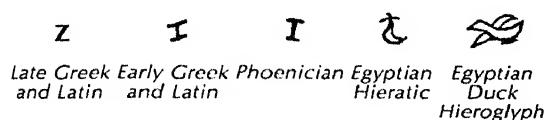
YÜMEN, city of the People's Republic of China, in Kansu Province, at the N. foot of the Kilien Mts., near the Shuleh R., 400 miles N.W. of Lanchow. Named for the adjacent Jade Gate in the Great Wall, it lies on the ancient Silk Road and on the Lanchow-Urumchi railroad. In a cattle-raising area, the city is a refining center for the most extensive producing oil fields in China, about 40 miles to the S.E. and in production since 1939. The municipality was created in 1955. The name is also spelled Yü-men. Pop. (1970 est.) 325,000.

YÜNNAN, province of s.w. People's Republic of China, bordered by Szechwan Province on the N., Kweichow Province and Kwangsi Chuang Autonomous Region on the E., North Vietnam and Laos on the S., and Burma on the W. Much of Yünnan is within the plateau of Tibet, which lies about 6500 ft. above sea level and is dominated in the N. and N.W. portions by great mountain ranges. The ranges, which trend in a N.-S. direction and vary in height from 12,000 to 16,000 ft., are cut by the gorges of the Yangtze, Mekong, and Salween rivers. The chief lakes are the Tien Chih and the Erh Hai. A significant percentage of the population consists of non-Chinese aboriginal tribes, including Lolos, Miaos, and Shans. Agriculture is carried on in the S.E. part of Yünnan; the chief crops are rice, sugar, wheat, tea, and opium poppy. Yünnan is rich in mineral resources, including tin, coal, copper, tungsten, antimony, salt, iron, gold, lead, and zinc. Kunming (q.v.) is the capital and chief commercial center. Other important cities are Mengtsz, Tali, and Paoshan.

Because of its inaccessibility, Yünnan long was virtually autonomous. In the 13th and 14th centuries it came under the control of the Mongol Yüan dynasty and in the 17th century it was incorporated into the Chinese empire. From 1855 to 1873 the province was the scene of an abortive Islam revolt. The Burma Road (q.v.) traverses Yünnan, and consequently the province was a strategic supply center during World War II. The Japanese occupied the S. part of the province from 1942 to 1944. Yünnan came under Chinese Communist control in 1950. Area, about 168,000 sq.mi.; pop. (1970 est.) 23,000,000.

YUOK. See AMERICAN INDIANS: *Indians of the United States and Canada: California Area.*

Z, twenty-sixth and last letter in the English alphabet. It was taken from the Latin alphabet, which derived it from Greek. The Greek letter was derived from a Phoenician one, which in turn was based upon Egyptian hieratic and hieroglyphic characters. Z was the seventh letter in the Phoenician, Greek, and early Latin alphabets. It was dropped from Latin about the 3rd century B.C., and restored in the 1st century B.C. in order to transliterate certain Greek words; in its second appearance in Latin the letter was placed at the end of the alphabet, the position it occupies in the alphabets of all the modern languages in which it appears. The history of the form of the character may be summarized as follows:



The normal *z* sound, occurring in such words as *zest* and *buzz* and in the name of the letter itself, is technically known as a voiced fricative consonant; it is produced by placing the tip of the tongue near the sockets of the upper front teeth and vibrating the vocal cords as air moves over the flattened edge of the tongue. This sound may be called a voiced *s*, and the letter *z* was first widely used in English during the Middle English period in order to distinguish the normal *z* from the normal *s* sound. The substitution was never thoroughly carried out, however, and the letter *s* invariably represented both the *s* and *z* sounds in inflectional endings and in most words of Latin origin; in modern English, it is *s* that usually indicates the *z* sound, as in *goes*, *man's*, *rose*, and *desire*. The *z* sound is often palatalized, producing the fricative voiced sound of *z* in the words *azure* and *seizure*; this sound, too, is more often represented by *s*, as in

measure and *treasure*. Although *z* occurs in some words derived from Anglo-Saxon, such as *freeze* and *graze*, usually to represent an *s* which in the older language was voiced, its appearance in a word (especially initially) generally indicates a foreign origin, most often Greek, occasionally Arabic; examples of such loan words are *zeal* and *zodiac*, derived from Greek, and *zenith*, derived from Arabic.

As an abbreviation, the capital *Z* stands for *zenith* distance in astronomy and for atomic number in chemistry. In science and technology, the lowercase *z* is used as an abbreviation for *zero*, and in algebra, it stands for an unknown quantity or variable; in analytic geometry it stands for one of the systems of point coordinates. The capital or lowercase forms of the letter are used in geography as an abbreviation for *zone*. In medieval Roman numerals, the capital letter was a symbol for the number 2000 and, in the form *Z*, 2,000,000. The capital and lowercase *Z* may be used to indicate the twenty-sixth or, when *J*, *V*, and *W* are not used, the twenty-third member of a series, class, group, or order. The capital letter is sometimes used in compound words to indicate anything having the shape of *Z*.

M.P.
ZABRZE (Ger. *Hindenburg*), city of Poland, in Katowice Province, about 50 miles N.E. of Cracow. It is a railroad junction and one of the principal industrial centers of the Silesian coal-mining region. Manufactures include iron and steel, coke, and chemicals. Zabrze dates from about 1300, but it did not become important until the 19th century. In 1915, during World War I, Germany annexed the city and renamed it *Hindenburg* in honor of the German field marshal Paul von Hindenburg (q.v.). During World War II it sustained heavy damage and in 1945 it was occupied by Soviet troops. In the same year, by a decision of the Potsdam Conference (q.v.), the city was restored to Poland. It

ZACHARY

was known thereafter by its original name. Pop. (1971) 197,000.

ZACHARY, Saint or ZACHARIAS, Saint (690?–752), pope from 741 to 752, born in southern Italy of Greek parents. He was closely associated with Pope Gregory III (see under GREGORY), but otherwise little is known about his early career. By timely assertions of his authority as pope, Zachary helped to prepare the way for the ascendancy of the Western Church in the temporal affairs of Europe; see CHRISTIAN CHURCH, HISTORY OF THE. He skillfully conciliated the Lombards (q.v.), a Germanic people who had occupied papal holdings in Italy, and persuaded them to restore many towns and territories to the church. In 751, with his support, Pepin the Short (see under PEPIN), the effectual ruler of the Frankish realm, deposed its titular ruler, Childeric III (r. 741–51). By giving Pepin his official blessing Zachary created strong bonds between the papacy and the powerful Carolingian (q.v.) dynasty that Pepin founded. See FRANCE: History: The Carolingians. Zachary translated into Greek *The Dialogues of Saint Gregory the Great*. His traditional feast day is March 5.

ZAGREB (anc. *Zagrabia*), city of Yugoslavia, and capital of the constituent republic of Croatia, on the Sava R., about 225 miles n.w. of Belgrade. The second largest city of the country and an industrial center, Zagreb has plants producing chemicals, machinery, leather goods, paper, metals, and textiles. A cultural center as well, the city has a university founded in 1669, an opera house, music and art academies, colleges, museums, and art galleries. Noteworthy landmarks include an 18th century palace and remnants of an 11th-century cathedral.

The site of present-day Zagreb was occupied by a settlement in Roman times. In 1093 Zagreb became a bishop's see, and in 1242 it became a free royal city. The city was made the capital of Croatia and Slavonia in 1867 and became part of Yugoslavia in 1918. Pop. (1971) 566,084.

ZAGROS MOUNTAINS. See IRAN: *The Land*.

ZAHARIAS, Babe Didrikson (1913–56), American athlete, born Mildred Babe Didrikson in Port Arthur, Texas. Named woman athlete of the first half of the 20th century by an Associated Press poll in 1950, she excelled in many sports, including basketball, swimming, track and field, and especially golf. In her teens she twice won a place on the All-American women's basketball team and established three national records in track and field events. A contender in the Olympic Games held in 1932 in Los Angeles, Calif., she not only won but set new records for the javelin throw (143 ft. 4 in.) and the 80-meter

hurdle (11.7 sec.). She then played professional basketball, appeared in vaudeville, and learned to play golf. Between 1936 and 1954 she won every major women's golf championship, including the United States amateur championship (1946) and the world championship (1948, 1949, 1950, 1951) and U.S. Women's Open (1948, 1950, and 1954), both professional tournaments. Her autobiography, *This Life I've Led*, was published in 1955.

ZAHAROFF, Sir Basil (1849–1936), Greek financier and manufacturer of munitions, born probably in Mugla, Turkey, of Greek parents, and educated in England. As director of Vickers-Armstrong, a British munitions firm, and through his holdings in shipbuilding and oil enterprises, he became one of the world's wealthiest and most influential men. He was a friend and adviser to such notable statesmen as Premier Georges Clemenceau (q.v.) of France and Prime Minister David Lloyd George (see LLOYD GEORGE, DAVID) of Great Britain. For his services to Britain during World War I, Zaharoff was knighted in 1918. He is also noted for his many philanthropies, primarily in the field of education; he endowed professorships in aviation at the universities of London, Paris, and Petrograd (now Leningrad A.A. Zhdanov State University); a professorship of French literature at the University of Oxford; and a professorship of English literature at the University of Paris.

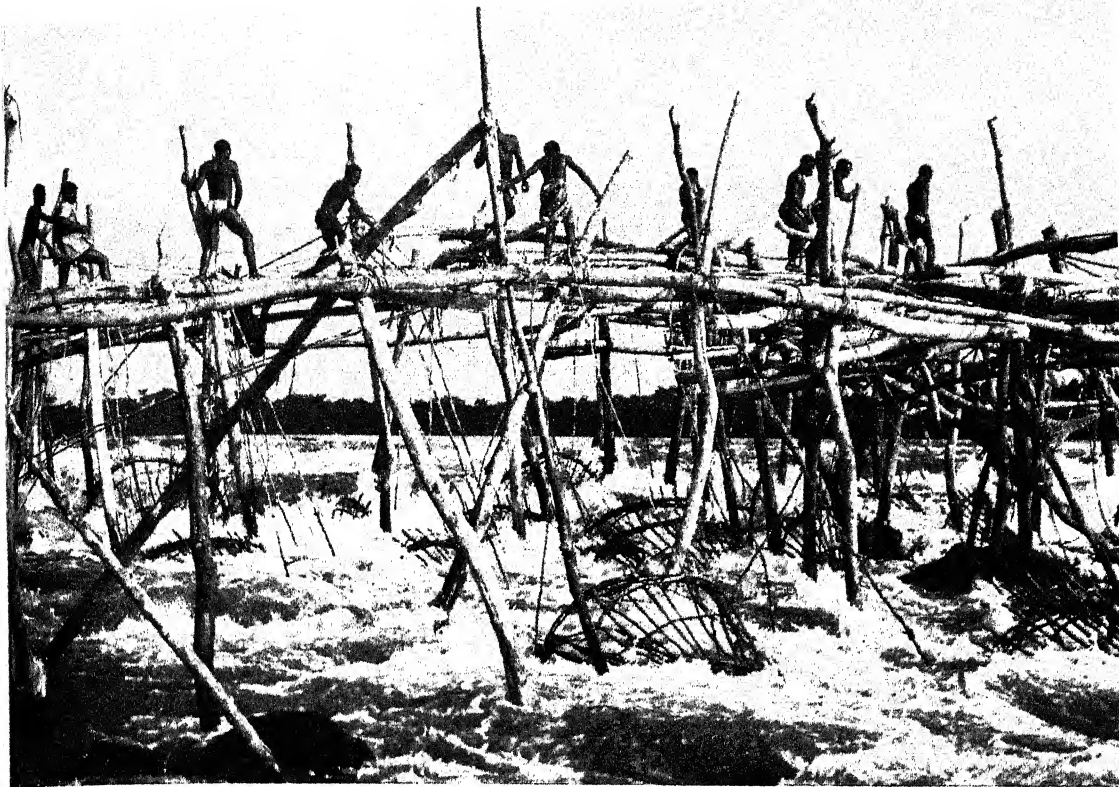
ZAHIR SHAH. See AFGHANISTAN: *History: The New Kingdom*.

ZAIBATSU. See MONOPOLY AND COMPETITION: *History: Historic Cartels*.

ZAIRE, REPUBLIC OF, nation of central Africa. It was known as the Belgian Congo until in 1960 it became independent as the Democratic Republic of the Congo; its name was changed to Zaire in 1971. The country is bounded on the n. by the Central African Republic and Sudan, on the e. by Uganda, Rwanda, Burundi, and Lake Tanganyika (which separates it from Tanzania), on the s. by Zambia, on the s.w. by Angola, and on the w. by Angola (Cabinda enclave) and the Republic of Congo. It is situated between lat. 5°23' N. and lat. 13°27' S. and between long. 13°10' E. and long. 31°18' E. The extreme w. portion is a narrow wedge terminating in a 25-mi. strip along the Atlantic Ocean. The greatest width of the country is about 1200 mi.; its greatest length from n. to s. is 1250 mi. Its total area is about 905,380 sq.mi.

THE LAND

The dominant physiographic feature is the basin of the Congo River (q.v.), renamed Zaire R. in 1971, a vast depression that sloped upward on



Tribesmen tend to their fish traps, which are attached to a wooden structure they have erected on the Congo River near Kisangani, Republic of Zaire.

George Holton-Photo Researchers

all sides into mountain ranges. The largest of these, on the E. border of Zaire, is the Mitumba Range, with elevations above 16,000 ft. The Ubangi R., chief N. tributary of the Congo, rises on the N.W. slopes of this range. In the S.E. the basin is fringed by rugged mountain country, sometimes called the Katanga Plateau. This region, about 4000 ft. above sea level, contains rich copper fields, uranium, and other mineral deposits. In the S.W. the mountain chains are collectively designated the Angola Plateau. Here are located the sources of the Kasai R. (q.v.), chief S. affluent of the Congo R. Both the Congo R. basin and the mountain regions are traversed by numerous rivers, the valleys of which are covered with dense vegetation. Virtually impenetrable equatorial forests occupy the E. and N.E. portions of the country. The largest, known variously as the Ituri, Great Congo, Pygmy, and Stanley Forest, extends E. from the confluence of the Aruwimi and Congo rivers nearly to Lake Albert, covering some 25,000 sq.mi. In this area, on the Ugandan border, are the Ruwenzori Mts. Large regions of the Congo basin consist of savanna land.

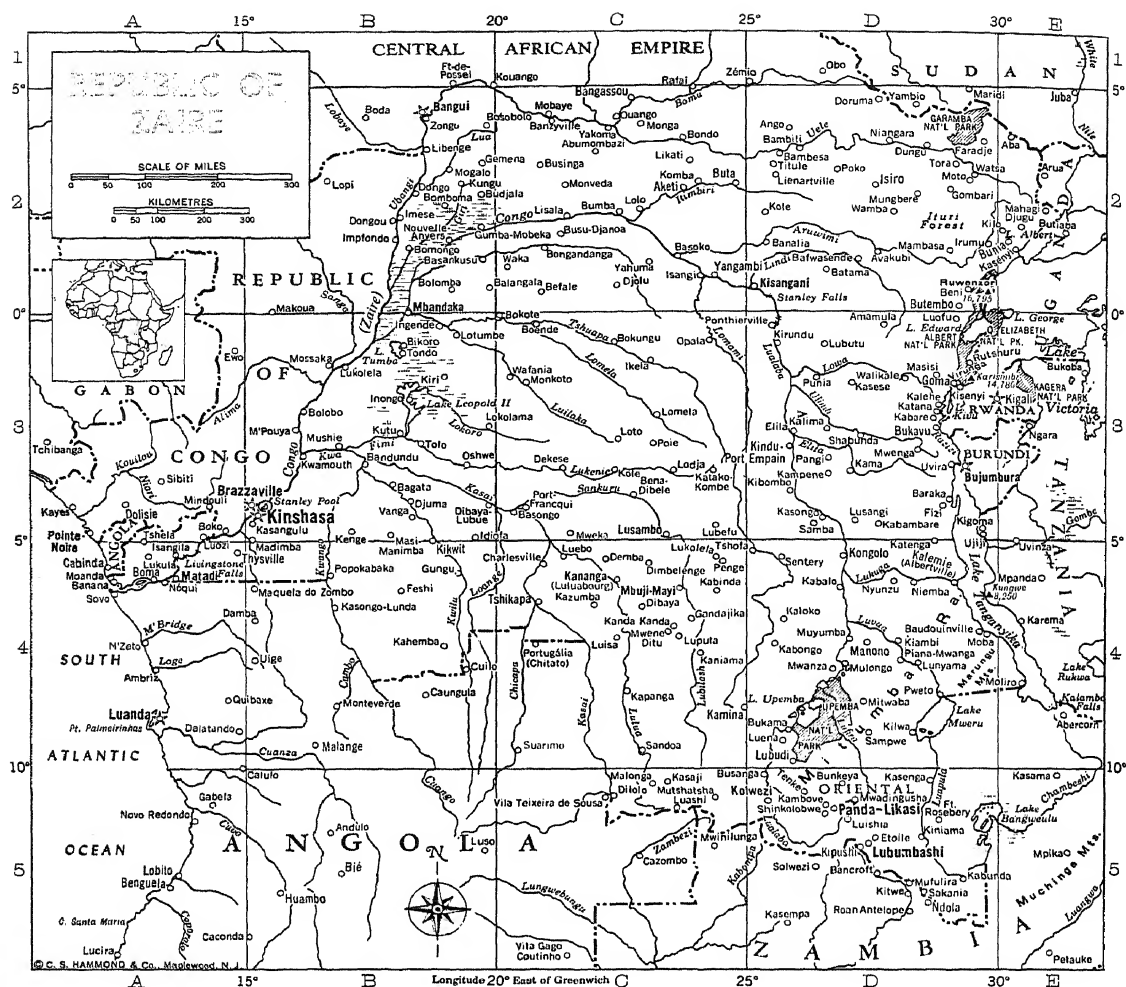
Climate. Except in the upland regions, the climate of the country is very hot and humid. The mean annual temperature is approximately 80° F. in the low central area, with extremes considerably higher in February, the hottest month. In

areas with altitudes above 5000 ft. the mean annual temperature is about 66° F. Frequent heavy rains occur from April to November N. of the equator and from October through May S. of the equator.

Natural Resources. Zaire has vast mineral deposits, notably copper, uranium, gold, and diamonds. The wide range of climatic areas permits diversified agricultural production. The Congo R. and its affluents provide a magnificent network of navigable waterways.

Plants and Animals. The vegetation of the republic is extremely rich and diversified. Rubber trees of various species and oil palms are indigenous to the region, as are coffee and cotton. Among the native fruit trees are banana, coconut palm, and plantain. Timber trees occur abundantly in a large variety of species, including teak, ebony, African cedar, mahogany, *lignum vitae*, and redwood. Animal life is abundant and varied. Larger animals include the elephant, lion, leopard, chimpanzee, gorilla, giraffe, hippopotamus, okapi, zebra, wolf, and buffalo. The mamba, python, and crocodile are among the numerous reptiles. Among the many species of birds are parrots, pelicans, flamingos,

ZAIRE, REPUBLIC OF



cuckoos, sunbirds, herons, and the spur-winged plover. Insects are exceedingly numerous, particularly ants, termites, and mosquitoes, including the *Anopheles* mosquito, host of the malaria parasite. Another disease-bearing insect, prevalent in the lowlands, is the tsetse fly, disseminator of sleeping sickness (q.v.).

Waterpower. Zaire has vast hydroelectric potential. A major hydroelectric project at Inga, on the Congo R., opened in 1972, has an ultimate annual capacity of 30,000,000 kw. Almost all generating plants have been built near the mines to serve mining operations. In the early 1970's more than 3,000,000,000 kw hours of the annual total of 3,700,000,000 kw hours was produced in hydroelectric installations.

THE PEOPLE

The population is largely agricultural, and comprises a majority of Negroid peoples, a sizable minority of Sudanese, and small numbers of Nilotic, Pygmy, and Hamitic peoples. A number of

Europeans live in Zaire, primarily Belgians; the number in the late 1960's had dropped by more than 60 percent since the late 1950's.

Population. The population of the Republic of Zaire (census 1970) was 21,637,876; the United Nations estimated (1971) 22,480,000. The overall population density is about 26 per sq.mi. (1971 U.N. est.). The population is concentrated in the E. highlands and along the lower Congo R. Urbanization has been very rapid; about 25 percent of the total population was living in or around towns in the early 1970's.

Political Divisions. In December, 1966, the number of regions was reduced from twelve to nine: Bandundu, Bas-Zaire, Equateur, Haut-Zaire, Kasai East, Kasai West, Kinshasa, Kivu, and Shaba.

Opposite page: The turbulent Kwango River spills over a waterfall on its course from the highlands of Angola to its junction with the Congo River north of Kinshasa.

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ZAIRE, REPUBLIC OF

Principal Cities. The capital and largest city is Kinshasa (formerly Léopoldville), with a population of 1,323,039 in 1970. Among other major cities, with 1970 (census) population figures, are Lubumbashi (formerly Elisabethville), 318,000, and Kisangani (formerly Stanleyville), 229,596. Smaller cities include Bukavu (formerly Costermansville); Matadi, the principal port; Mbandaka (formerly Coquilhatville); and Boma, formerly the capital of both the Congo Free State and the Belgian Congo, and now a commercial center.

Religion and Language. Christianity has about 5,000,000 adherents and Muslims number about 105,000. The majority of the people still adhere to traditional animist beliefs. French is the official language as well as the principal business and social language. Four languages, basically of the Bantu family, are widely spoken: Swahili in the E. and S., Kikongo in the lower regions, Tshiluba in Kasai, and Lingala along most of the Congo R. See also AFRICAN LANGUAGES; AFRICAN LITERATURE; ANIMISM.

Education. About half of the children attend primary school. Secondary schools, neglected by the Belgians, tripled in number between 1958 and 1963. Two universities functioned in the early 1970's, one near Kinshasa (Lovanium), a state-aided Catholic university, and the National University of Zaire, with campuses at Kinshasa, Lubumbashi, and Kisangani and a total enrollment of about 10,000 annually.

Congolese folkways and culture, although influenced by European life in the urban centers, remain largely intact among the different ethnic groups. The country has several museums, the principal ones being in Kinshasa and Lubumbashi. The universities, as well as mission schools and private organizations, maintain libraries.

THE ECONOMY

The general disruption that occurred throughout the country following independence has contributed to a reduction in the agricultural output below the levels achieved prior to independence. The mining industry, after a sharp decline, reached record levels in the early 1970's. In a recent year budget figures showed about \$443,000,000 in revenue and about \$587,000,000 in expenditures.

Agriculture. Large areas of the Congo R. basin are fertile and well suited for cultivation. In the late 1960's improved techniques raised palm-oil production, quadrupled the yield of rubber and cocoa, increased the production of coffee and corn more than fivefold, and greatly increased the yield of rice, cassava, cotton, and bananas.

Nevertheless, Zaire had to import corn, its staple, from Zambia. Plantation agriculture, primarily coffee, has been better able to withstand the vicissitudes in the political and economic life of the country than either the production of cotton and palm products or peasant farming. Agriculture in many parts of the country has reverted to subsistence farming. Cattle raising is confined to elevated regions that are free of the tsetse fly.

Mining. Mineral deposits constitute the principal source of wealth of the republic. Zaire is the largest producer of cobalt and industrial diamonds in the world, but copper is the most valuable exported mineral. Other minerals produced in significant quantities include uranium, tin, gold, zinc concentrates, manganese ores, and cadmium.

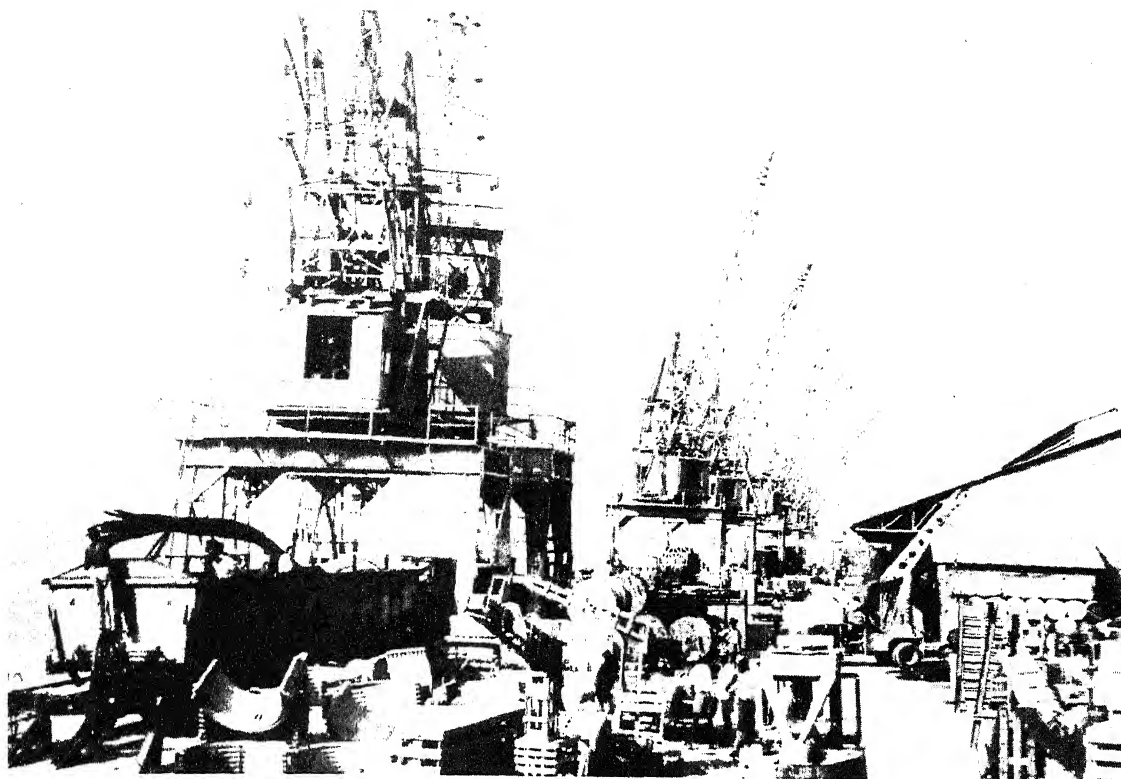
Manufacturing. Industry is fairly well developed. In the early 1970's Zaire produced about 641,000 tons of petroleum products, 1,350,000 tons of tin, 455,000 tons of cement, 279,000 tons of refined copper, 63,000 tons of zinc, 50,000 tons of refined sugar, 141,000 tons of sulfuric acid, and 104,000,000 gal. of beer.

Currency and Banking. The unit of currency is the zaire, consisting of 100 makuta (2.06 zaire equal U.S.\$1; 1974). The Bank of Zaire is the national bank; a number of domestic banks and branches of foreign banks are also in operation.

Commerce and Trade. Copper is the principal export, representing 50 percent of total export revenues. Other products exported include diamonds and coffee. Exports in the early 1970's totaled about \$702,000,000 annually and imports, about \$657,000,000. The principal export trade of Zaire, by value, is with Belgium, Italy, France, and Great Britain. The economy was impaired in the early 1970's by low world demand for copper and consequent reduced prices, circumstances that led to a marked budget deficit.

The country suffered a catastrophic decline in export earnings during the first few years after independence. This was due, in part, to the secession of Katanga and South Kasai, the mineral production of which represented about 50 percent of the export earnings. Another factor was the sharp decline in the export of agricultural crops such as cotton and palm-kernel oil because of the exodus of Europeans and the length of the rebellion. The reintegration of South Kasai in the fall of 1962 and of Katanga in January, 1963, helped restore much of the lost earning power of the new nation.

Transportation. The approximately 3600 mi. of railroad provide important connections within the country, with Benguela (q.v.) in An-



Kinshasa, on the Congo, or Zaire, River, is an important terminus for ships coming downriver from Kisangani, more than 1000 mi. upstream.

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gola, and with E. and S. African points. The total length of the road system is about 90,000 mi. Inland waterways are extensively utilized. The Congo R. is navigable from its mouth to Matadi, a distance of 83 mi. From Matadi to Kinshasa, which are linked by a 249-mi. railway, the river is unnavigable, but beyond Kinshasa navigation is possible for more than 1000 mi. Navigable inland waterways, over most of which river steamers are regularly routed, total about 8400 mi. The country has five international airports.

Communications. Zaire is heavily dependent on air and telegraph services for internal communication. A national broadcasting system is based at Kinshasa, and a television station was opened in 1966. Thirteen daily newspapers are published in various cities.

GOVERNMENT

In accord with the constitution adopted by a referendum held in June, 1967, Zaire has a presidential executive system. The president appoints the ministers of government. A single-house legislature is elected by popular vote for terms of five years. In 1970 the Popular Movement of the Revolution was declared the only legal political party; it was founded by President Mobutu Sese Seko (1930–), who assumed this name in 1972 (see *History*, below).

The nine regions are ruled by governors appointed by the president; the provincial assemblies are purely consultative bodies.

HISTORY

Early Congolese history is still largely unknown. There are records, however, of European explorations of the region beginning in the 15th century. The Portuguese had some contact with the kingdom of the Congo beginning in 1482, when the Portuguese navigator Diogo Cam (q.v.) visited the mouth of the Congo R. It is believed that at its height the kingdom extended from the region that is now Angola into Gabon. In 1489 a Congolese embassy was sent to the Portuguese king, and in 1490 Franciscan missionaries and artisans from Portugal went to the Congo. The Congolese king was a convert to Christianity, but his attempts to impose the religion on his people provoked violent opposition. His son, Alfonso, who succeeded him in 1507, set out to Christianize the country. Able to read and write Portuguese, Alfonso adopted the Portuguese model for his government and built numerous churches. The kingdom declined, however, and memory of the Christian kingdom all but disappeared. The growing interest in Africa as a source of wealth was stimulated by the reports of explorers, notably Henry Morton Stanley (q.v.), who visited the interior of the Congo in 1877. As a result of a conference with Stanley, Leopold II (see *under* LEOPOLD), King of Belgium,



Young woman of Tusi descent, from the eastern region.

UPI

in 1878 organized the International Association of the Congo. The new organization immediately engaged Stanley to return to the territory in order to set up trading stations and establish friendly relations with the native chiefs. The explorer founded a number of posts, including Léopoldville (Kinshasa), and secured rights to extensive areas bordering the Congo R.

Conflicting claims advanced by various nations, notably Portugal and France, to territorial rights in the Congo region led to the convening in 1884 of the Conference of Berlin, which recognized the sovereignty of the African International Association; opened the Congo Free State, as the region was named, to trade of all nations; and outlawed the slave trade. The new State was placed under the personal sovereignty of King Leopold II in July, 1885.

Annexation by Belgium. Increasingly oppressive exploitation caused continued unrest among the Africans and led, early in the 20th century, to international protest. Public opinion forced Leopold to establish a commission of inquiry in 1904. The report of the commission revealed that the Africans were victims of a slave-labor system and of other abuses. These findings compelled the king to institute certain reforms, which were not very effective. As a result, the Belgian parliament in 1908 voted to annex the Congo Free State, making it a colony that became known as the Belgian Congo.

During World War I, Congolese troops effectively aided the Allied cause in Africa, conquering the German territory of Ruanda-Urundi, which was mandated by the League of Nations to Belgium in 1919.

Substantial expansion of the industrial facilities of the Congo took place during World War II. This process was particularly marked in the uranium, copper, palm-oil, and rubber industries. During the postwar years further increases in the industrial productivity of the colony occurred, and a series of reforms, designed to prepare the Congolese for eventual self-government, were initiated. On Dec. 8, 1957, the Africans took part for the first time in voting for elective places on the township councils, winning 130 of 170 seats. After nationalists demanding independence rioted in Kinshasa in 1959, the Belgian government announced a schedule for Congolese elections, which were to inaugurate self-rule. But a congress of leading nationalist parties insisted upon immediate full independence; the two principal parties were the Abako (Association of the Lower Congo), led by Joseph Kasavubu (1910?-69), and the Congolese National Movement, led by Patrice Lumumba (1925-61). Belgium then agreed to relinquish the colony. In elections held prior to independence, some forty parties presented candidates. Lumumba's Congolese National Movement showed the greatest strength; the Abako was second. By agreement between the two leading parties, Lumumba became premier-designate and Kasavubu was chosen as president. The independent Republic of the Congo was proclaimed in Kinshasa on June 30, 1960, by King Baudouin I (q.v.) of Belgium.

Independence and the Secession of Katanga. Violent disorders, stemming from tribal disputes, the disappointment of the parties excluded from the government, and a revolt of Congolese armed forces, began within one week of independence. With the intention of restoring order and suppressing maltreatment of whites, Belgian forces still in the Congo were redeployed and additional troops were flown into the country, despite the objections of Lumumba. The action, interpreted as an attempt to reimpose Belgian authority, provoked even greater violence against the Europeans. The political picture was further complicated when on July 11 Moïse Tshombe (1919-69), then premier of Katanga Province, proclaimed that province to be an independent country and requested Belgian military aid. In response to an appeal from Lumumba, the United Nations Security Council authorized Secretary-General Dag

Hammar skjöld (q.v.), the U.N. secretary-general, to recruit a military force to be sent to the Congo to restore order; the Security Council also demanded withdrawal of Belgian forces. The U.N. force, comprising units from African countries, Sweden, and Ireland, gradually began to supplant Belgian troops. When the Security Council ruled that U.N. forces were not to be employed to affect the outcome of any internal conflict in the province, Tshombe, reassured, permitted U.N. troops to enter Katanga.

In September Soviet technicians and advisers were flown into the Congo, causing much tension between the United States and the Soviet Union. Tension increased when President Kasavubu announced that he had dismissed Premier Lumumba, replacing him with Joseph Ileo (1922–). Lumumba claimed that his dismissal was illegal and that Kasavubu was no longer president. On Sept. 13 the U.N. forces gave up control of the airports and Radio Kinshasa to Lumumba. But the Congo army, led by Colonel Joseph-Désiré Mobutu (now Mobutu Sese Seko), a supporter of Kasavubu, seized control of the government, and Mobutu ordered Soviet and Czechoslovak ambassadors out of the country. President Kasavubu, on Sept. 29, transferred executive and administrative authority of the Congo to the College of High Commissioners, the caretaker government sponsored by Mobutu. In November the U.N. General Assembly voted to seat the Kasavubu delegation.

Shortly afterwards, Lumumba escaped from his U.N.-guarded villa in Kinshasa. He was captured the same day and was told by Mobutu that he would have to stand trial for inciting the Congolese army to rebellion.

On Dec. 13, 1960, Antoine Gizenga (1925–), former deputy premier in the Lumumba government, proclaimed himself premier, and designated Kisangani as the capital of the Congo. Within the next few months his government was recognized by most Communist and Arab nations and by Ghana. On Jan. 9, 1961, pro-Lumumba soldiers invaded northern Katanga, and the U.N. Congo Command sent troops there to prevent outbreak of civil war.

President Kasavubu in February replaced the caretaker government of Mobutu with a new provisional government including members of the former parliament and Joseph Ileo as premier. Lumumba, who had been imprisoned in Katanga, escaped and while in flight was killed (Feb. 12). It was not established clearly who was responsible for the death of Lumumba. The Soviet Union accused Hammar skjöld of complicity in the murder of Lumumba and demanded that

he be dismissed from his U.N. post, whereas the Western powers continued to support the secretary-general.

United Nations Peace Efforts. On Feb. 21 the U.N. Security Council authorized the U.N. to use force to prevent civil war in the Congo and demanded withdrawal of all foreign military personnel not under U.N. command. Opposing the Council decision and hoping to forestall further U.N. intervention, eighteen leaders of Congolese factions (not including Gizenga) on March 12 agreed to abolish the central government in favor of a confederation of sovereign states. At a follow-up meeting convened in April, Tshombe withdrew his cooperation. Arrested and charged with treason, he secured his release by agreeing to dismiss all foreign advisers and military forces in Katanga, but repudiated his assurances when he returned to Elisabethville (now Lubumbashi). The U.N. Command launched limited military action against his forces in September and again in December. While trying to arrange a cease-fire between the U.N. forces and the Katangese forces in September, Secretary-General Hammar skjöld was killed under mysterious circumstances in an airplane crash at Ndola, Zambia.

Meanwhile, Gizenga agreed to join the central government after former senate member Cyrille Adoula (1921–), named Congolese premier on Aug. 2, promised to follow the policies of Lumumba. Gizenga was made first vice-premier, but was removed from this post and cen-

A student puts the finishing touches on a sculpture at an art school in Kinshasa. UPI



ZAIRE, REPUBLIC OF

sured by parliament in January, 1962, for defying a parliamentary resolution that he come to Kinshasa from Kisangani to face secession charges.

Tshombe, during the first half of 1962, held intermittent talks with Adoula, but the two leaders failed to reach a final agreement. To compel Tshombe to come to terms, Acting U.N. Secretary-General U Thant (q.v.) pressed for economic sanctions against Katanga and proposed a three-stage plan for ending Katanga's secession. Tshombe announced his acceptance of the plan but made little effort to implement it. Adopting a firmer stand against the secession of Katanga, Adoula demanded that the U.N. plan be put into effect, by force if necessary.

In December U.N. forces moved decisively against Katanga and gained control of Lubumbashi. Tshombe, fleeing before U.N. troops, established his last stronghold at Kolwezi. On Jan. 15, 1963, he announced surrender to U.N. integration demands and was promised amnesty for himself and his followers if their threats to destroy Kolwezi mining installations were not carried out. A few months later Premier Adoula formed a new cabinet, which included Katanga representatives and gave strongest representation to the Lumumbist party. Strikes and rebellions continued to beset the country, however, and in June, 1964, Adoula resigned as premier. A new constitution was adopted and a government was formed under Tshombe. Then in August Kisangani fell to Lumumbist rebels. After troops of the Congolese National Army, aided by white mercenaries, began a drive to recapture the city, the rebels threatened to kill Whites being held hostage in Kisangani; among the hostages were about sixty Americans. On Nov. 24 Belgian paratroopers, carried in U.S. planes, landed in Kisangani and, together with Congolese troops, recaptured the city. The U.S. and Belgian troops left after their rescue mission.

The Mobutu Government. A fragile coalition organized by Tshombe won the parliamentary elections of early 1965, but shortly thereafter Kasavubu ousted Tshombe from the premiership. (Tshombe left the country and died in Algeria in 1969.) In late 1965 Mobutu again intervened, installing himself as president in place of Kasavubu. In 1966 Mobutu established a presidential form of government; the change was formalized in a new constitution adopted in 1967. In his first years as president Mobutu brought political stability to the country, although there were a number of short-lived regionally based revolts, and students occasionally protested his allegedly dictatorial rule. Some foreign-owned mining firms were nationalized,

and in 1966 the European names of several cities were replaced by African names (Léopoldville became Kinshasa; Stanleyville, Kisangani).

In 1970 Mobutu was elected to a seven-year term as president, and in the early 1970's he undertook a major program of Africanization. In 1971 the country's name was changed to Zaire, and in 1972 the president renamed himself Mobutu Sese Seko, at the same time urging other Zairians to drop their non-African names. In 1973 many foreign concerns were taken over by the government. Some economic-development projects were completed, but the country remained very dependent on income from copper exports. World copper prices fell sharply in the mid-1970's, and largely as a result of the consequent steep drop in Zaire's export earnings the country's foreign debt rose to more than \$2 billion by the late 1970's. At the same time the domestic economy experienced very high rates of unemployment and inflation. In 1977 Mobutu was reelected president. In 1977, and again in 1978, Zaire (with the help of Belgium, France, Morocco, and other countries) repulsed invasions from Angola by former residents of Shaba region (as Katanga had been renamed in 1972). **ZAMBEZI** or **ZAMBESI**, fourth largest river of Africa, about 1600 mi. in length and draining an area of some 500,000 sq.mi. It rises in the n.w. corner of Zambia and flows in a great double curve s. to the Indian Ocean. From its headwaters, about 5000 ft. above sea level, the Zambezi flows through E. Angola, traverses W. Zambia, and forms the border of N.E. Botswana; it forms the boundary between Zambia and Rhodesia, and, flowing through Kariba Lake created by the hydroelectric Kariba Dam (see DAM), it crosses central Mozambique, and flows into the Mozambique Channel and empties into the Indian Ocean through several mouths. In its upper course, totaling about 500 mi., the Zambezi falls only about 600 ft. About 60 mi. below its confluence with the Kwando R. it forms the great cataract known as Victoria Falls (q.v.), and for the next 45 mi. it rushes through a narrow gorge 400 ft. deep. The Zambezi then enters its middle course and flows through hilly country for about 800 mi. to Quebrabasa Rapids, the last great natural barrier to navigation, in Mozambique. In its lower course the Zambezi flows through a broad valley to the sea. Besides the Kwando R., the chief tributaries of the upper river are the Kabompo and the Lungwebungu. The Zambezi receives no important tributaries in its middle course; the chief affluent of the lower river is the Shire.

Despite such interruptions as cataracts, rap-

ids, and sand bars, the Zambezi is navigable for long distances. The navigable reaches of the river and its tributaries total about 400 mi. The Scottish missionary and explorer David Livingstone (q.v.) was the first European to explore the Zambezi.

ZAMBIA, republic in south-central Africa, formerly known as Northern Rhodesia, member of the Commonwealth of Nations. It is bounded on the N. by the Republic of Zaire and by Tanzania, on the E. by Malawi, on the S.E. by Mozambique, on the S. by Rhodesia, Botswana, and the Caprivi Strip of South-West Africa, and on the W. by Angola. It extends from about lat. 8° S. to lat. 17°20' S. and from long. 22° E. to long. 33°40' E. The area is 290,320 sq.mi.

THE LAND

Most of Zambia is high plateau, at altitudes between 3500 and 4500 ft., with mountains in the N.E. exceeding 7000 ft. Major rivers are the Zambezi R. and its tributaries, the Kafue and the Luangwa, in the S. and W., and the Luapula R. in the N. The country has a savanna type of vegetation. Teak forests grow in the W. districts. Animals include the elephant, lion, rhinoceros, and several varieties of antelope.

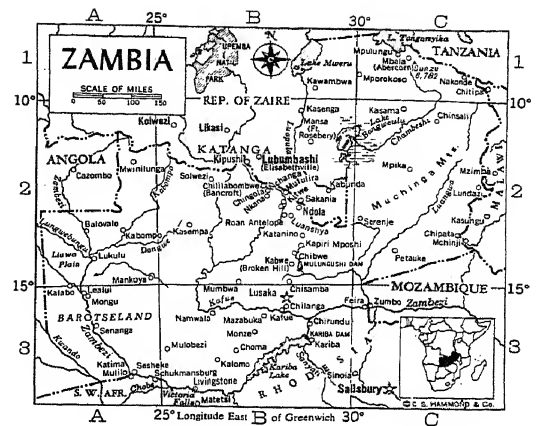
Climate. Although lying within the Tropic Zone, much of Zambia enjoys a pleasant climate because of the high altitude. Climate varies greatly between the river valleys and the elevated plateau. Maramba, in the Zambezi valley, has extreme temperatures of 27° F. and 105° F. and annual rainfall of nearly 30 in. Lusaka, at 4100 ft., has a yearly high of about 100° F. and a low of 39° F. with an average rainfall of 32 in. The main rainy season lasts from mid-November to early April.

Natural Resources. Of overwhelming importance to Zambia are the rich mineral veins of its copper belt; the belt extends down into the country from the S. part of the Republic of Zaire. Zambia also has substantial hydroelectric potential. The Kariba Dam on the Zambezi R. is the main power source. Zambia shares the Kariba system with Rhodesia. Other stations on the Lunsemfwa and Mulungushi rivers serve Broken Hill. Plans are well advanced for building installations on the Kafue R. The total electrical power consumed annually in the early 1970's, including imports, was 4,371,000,000 kw hours.

THE PEOPLE

The population, predominantly rural, is almost entirely African. A white minority, about 2 percent of the total population, has exerted considerable influence in industrial activities.

Population. The population (census 1969) was 4,056,995; the United Nations estimated (1971)



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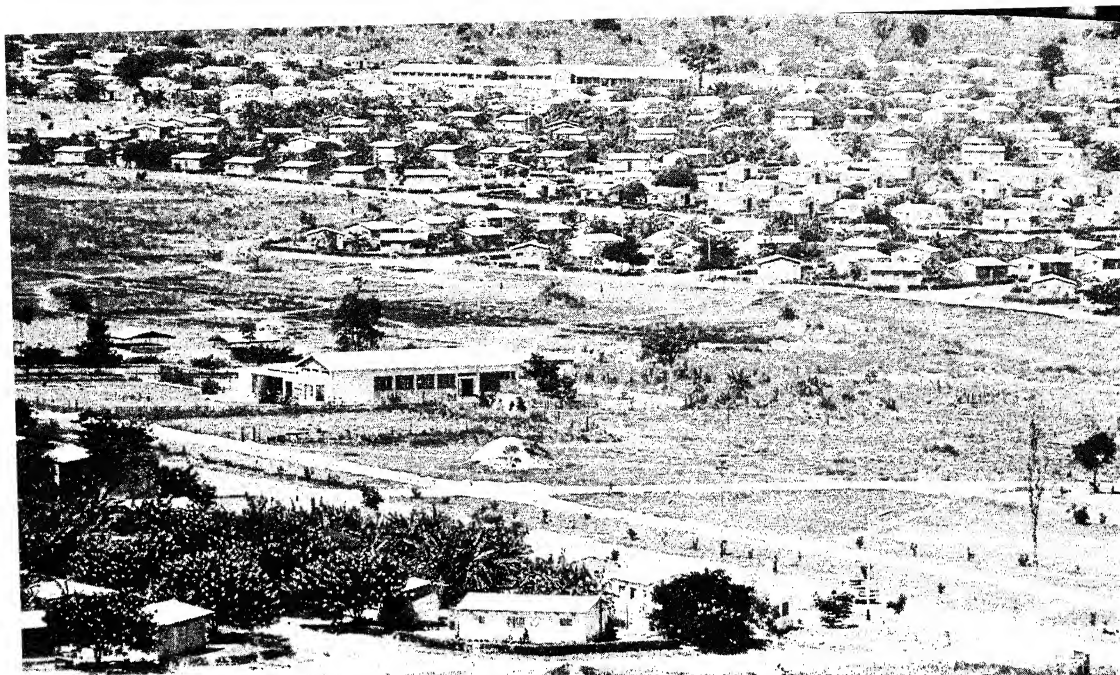
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Kariba (lake)	B 3
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4,275,000. This included about 59,000 Europeans, Asians, and people of mixed descent. The African majority belongs to some seventy-three tribes, of which the largest are the Bemba, Lozi, and Tonga. The overall population density is 16 per sq.mi. (U.N. est. 1970); much of the N.E. and W. is sparsely inhabited.

Political Divisions and Principal Cities. Zambia is divided into 8 provinces, each administered by a resident minister. Lusaka, the capital, had a population in 1972 of about 347,900. Other major centers are the towns of Ndola (201,300), Kitwe (179,300), Mufulira (124,100), and Luanshya (110,500), all in the copper belt.

Religion and Language. Most of the people retain their traditional tribal beliefs. Christians



Workers' housing, part of a community-development project in the densely populated copper belt of Zambia.

United Nations

make up about 20 percent of the population and include all Europeans. The Asians are mainly Muslims. More than 40 African languages and dialects are spoken, the most important being Bemba, Lozi, Luvale, Tonga, and Nyanga. The official language is English.

Education. Primary education is compulsory. In the early 1970's about 730,000 pupils were enrolled in 2600 primary schools and 56,000 in 114 secondary schools. Teacher-training colleges had an enrollment of about 2400. The University of Zambia, at Lusaka, which opened in 1966, has about 1700 students.

The Livingstone Museum, at Maramba, has a collection relating to the archeology and natural history of southern Africa. The Institute for Social Studies of the University of Zambia publishes studies relating to central Africa.

THE ECONOMY

The wealth of Zambia is based largely on mining in the rich copper belt. Some processing and manufacturing has been started since independence, and further diversification of the economy is being planned. The 1973 budget estimate showed about \$443,000,000 in revenue and \$473,000,000 in expenditures.

Agriculture. The most important cash crop is tobacco; the annual yield in the early 1970's was more than 6500 tons. Other commercial crops are peanuts and corn. The 1972-76 five-year plan emphasizes rural development and self-sufficiency in corn. Beef and dairy cattle are

raised for domestic use. Forest and fishing industries are under development.

Mining. The copper mines of Zambia are among the richest in the world. Copper production in the early 1970's totaled about 650,000 tons annually. Lead, zinc, manganese, and cobalt are also mined. Annual value of mineral production was about \$755,000,000, of which copper accounted for nearly 95 percent.

Manufacturing. Principal manufactured items include food products, clothing and shoes, transport equipment, and cement. Grain milling and smelting and refining of copper are also important.

Currency and Banking. The decimal system of currency, introduced in 1968, is based on the kwacha, consisting of 100 ngwee (1.62 kwachas equal U.S.\$1; 1974).

British commercial banks maintain branches in Zambia. The Land and Agricultural Bank of Zambia, founded in 1953, and the government-financed Finance Development Corporation provide loans for agriculture and industry.

Commerce and Trade. Imports, mainly machinery and transport equipment, mineral fuels and lubricants, chemicals, and manufactured goods, totaled about \$640,000,000 annually in the early 1970's. Imports from Rhodesia were drastically reduced following that country's declaration of independence in 1965 and its subsequent acceptance of segregationist policies. Exports totaled about \$776,000,000, the chief items being metals and tobacco.

Transportation and Communications. A railroad from Rhodesia runs to Maramba, Lusaka,

and Ndola, connecting with the Congo system, and thence to Benguela on the Atlantic coast of Angola. About 5700 mi. of surfaced roads connect the main towns of Zambia. Lusaka has an international airport. The government operates radio and television stations at Lusaka and Kitwe. In the early 1970's about 80,000 radios and 20,000 television receivers were in use.

Labor. Of the more than 350,000 people in paid employment in the early 1970's, about 58,000 were engaged in mining, 67,000 in construction, and 40,000 in agriculture.

GOVERNMENT

Zambia is a republic with a president elected by universal suffrage and a National Assembly of 125 elected members and 10 nominated members. The vice-president, named by the president, heads the assembly. In 1973 a new constitution was adopted, elevating the central committee of the United National Independence Party (U.N.I.P.), the sole legal party, above members of the cabinet.

The judicial system consists of a high court, a court of appeal, and lower courts on the British model. Some African customary law is still applied in special courts.

Health Services and Military Strength. Since independence Zambian authorities have placed emphasis on maintaining existing health services rather than expanding the system.

The armed forces of Zambia consist of an army of about 3000 and a small air force.

HISTORY

Knowledge of the early history of Zambia is

fragmentary. Zambia lies across one of the main north-to-south migration routes, which have yielded a series of archeological finds from split pebbles made 500,000 years ago to early Iron Age artifacts made in the first millennium A.D. The country was crossed and recrossed by invaders; the present African population arrived in the 17th century.

In the 19th century Arab slave traders were active in the region. In 1851 the Scottish missionary David Livingstone (q.v.) reached the upper Zambezi, and in the next few years British missionaries arrived in increasing numbers. In 1900, Lewanika, ruler of the Lozi, accepted British protection in exchange for the assignment of mineral rights to the British South Africa Company, led by Cecil John Rhodes (q.v.). The first copper mine was in operation in 1911, and the industry grew rapidly, attracting settlers from Europe and South Africa. In 1924 the British crown took over control of the country, then called Northern Rhodesia.

Over the opposition of Africans, of whom the first two were admitted to the legislative council in 1948, Northern Rhodesia was joined to Southern Rhodesia and Nyasaland in the Federation of Rhodesia and Nyasaland in 1953; see RHODESIA AND NYASALAND, FEDERATION OF.

African representation in the administration of Northern Rhodesia was progressively enlarged and supported by nationalist parties, notably the African National Congress, founded

A Zambian boy.

United Nations



ZAMBOANGA

in 1948. Faced with African pressure, the British agreed to the breakup of the federation, effective 1963.

In elections in 1962 the United National Independence Party (U.N.I.P.) led by Kenneth Kaunda (1924–) won 14 seats, and it formed a coalition with the African National Congress, from which it had split in 1958. In 1963 the country was made self-governing internally, and in elections in 1964 the U.N.I.P. won 55 out of 75 seats. The country became independent on Oct. 24, 1964, as the Republic of Zambia, with Kaunda as president; he was reelected in 1968, 1973, and 1978. In 1972 the ruling U.N.I.P. was made the country's sole legal political party.

During the early 1970's Zambia enjoyed relative prosperity as copper fetched high prices on world markets; in 1971 the government acquired control of the country's copper-mining concerns. Kaunda was a strong advocate of black-majority rule in white-dominated Rhodesia and South Africa, which caused recurring conflicts with these countries; as a result, rail contact with the sea through Rhodesia was cut off from 1973 to 1978. Because it allowed its territory to be used as a base by Rhodesian rebels, Zambia was also subjected to preemptive and retaliatory raids by Zimbabwe-Rhodesian government forces at the end of the 1970's. At the same time, the economy suffered severely from a fall in the world price of copper.

ZAMBOANGA, city and port of the Republic of the Philippines, in Zamboanga del Sur Province, on w. Mindanao Island, on Basilian Strait, about 530 miles s. of Manila. The city, part of the district called the city of Zamboanga, is a trading center and shipping point for a region producing copra, hemp, timber, and fish products. Zamboanga was founded in 1635 by the Spanish as a military base for campaigns against the Moro (q.v.). It was modernized during the period of United States administration (1898–1935) of the Philippines. The city of Zamboanga was constituted about 1940 and includes surrounding communities. During World War II the city was held by the Japanese. Pop. (1970) 199,901.

ZAMORA, city in Spain, and capital of Zamora Province, on the Douro R., about 130 miles n.w. of Madrid. The city is an episcopal see, a railroad junction, and the trade center for the surrounding agricultural region. Industrial products are textiles, pottery, leather goods, and brandy. Two bridges, one of which has 16 pointed arches and dates from the 14th century, span the Douro at Zamora. Other points of interest include several 12th-century churches and a castle dating from the Middle Ages (q.v.).

The site of Zamora was settled in pre-Roman times. Strongly fortified in the early Middle Ages, the city figured prominently, especially during the 10th century, in the wars between the Christians and the Moors. In the 11th century Zamora was constituted a part of the kingdoms of León and Castile (qq.v.). Pop. (1973 est.) 47,152.

ZAMORA Y TORRES, Niceto Alcalá. See SPAIN: *History: The Republic.*

ZANDE or ZANDEH, group of central African Negro tribes belonging to the Sudanic language group, and inhabiting the basins of the Uele and Ubangi rivers in the Republic of Zaire. Known also as the Azande, or Nyam-Nyam, they follow an economy based on agriculture and supplemented by hunting. Their houses, situated on homesteads scattered in clearings, are conical in shape, with thatched roofs and walls of mud or wattle and daub. Arts and crafts are well developed and include ivory and wood carving, metalwork, and pottery. Religion of the Zande centers around a supreme being called Mbolí to whom offerings are made. Divination plays an important part in daily ritual.

Beginning in the 18th century, a Zande clan known as the Avongara established a number of personal kingdoms throughout this central African region, and a number of Zande tribes are still ruled by members of this clan. Descent is generally traced in the male line. A chief rules over a group or tribe, and his brothers and sons hold subordinate posts as provincial administrators, appointing commoners as their deputies. The Zande today number about 750,000.

See also AFRICAN LANGUAGES: *The Niger-Kordofanian Family.*

ZANESVILLE, city in Ohio, and county seat of Muskingum Co., at the confluence of the Muskingum and Licking rivers, about 50 miles e. of Columbus. The city is within an agricultural, industrial, and mining region and has plants producing electrical equipment, glass, and iron and steel. Zanesville is the birthplace of the American author Zane Grey (q.v.). Settled about 1800, Zanesville was the State capital from 1810 to 1812. It was incorporated as a city in 1850. Pop. (1960) 39,077; (1970) 33,045.

ZANGWILL, Israel (1864–1926), British writer, born in London, England, of Russian parents, and educated at the Jews' Free School in London and the University of London. Beginning his career as a teacher and journalist, he established a reputation as a novelist in 1892, with *Children of the Ghetto*, which dealt with life among poor London Jews. This work was followed by *Ghetto Tragedies* (1893), *The King of*

Schnorrers (1894), *Ghetto Comedies* (1907), and other novels about Jewish life, as well as by stories, plays, essays, and poems. The title of his best-known play, *The Melting Pot* (1908), is still used to describe the fusion of cultures that characterizes America. Other plays by Zangwill include *Plaster Saints* (1914) and *We Moderns* (1924). He is noted for portraying modern Jewish life with sympathy and humor, neither misrepresenting Jews as stereotypes nor idealizing them.

Zangwill was an early leader of the modern Zionist movement; see ZIONISM. He led his followers out of the movement, however, when the Zionist Congress of 1905 rejected the British government's offer to open up territory in east Africa to Jewish settlement. The same year he founded the Jewish Territorial Organization, whose members sought unsuccessfully for some territory where Jews might make an autonomous settlement.

ZANZIBAR, city and port of Tanzania, in Zanzibar Province, on the w. coast of Zanzibar Island, about 40 miles N. of Dar es Salaam. It is an important shipping and commercial center and has excellent harbor facilities. Coconut oil, clove oil, and soap are important products. Portuguese traders founded Zanzibar in the 16th century and it was long a center of the slave trade. It served as the capital of the sultanate and later the protectorate for Zanzibar, before the island merged with Tanganyika in 1964 to form Tanzania (see TANZANIA, UNITED REPUBLIC OF). Pop. (latest census) 68,490.

ZAPATA, Emiliano (1877?–1919), Mexican revolutionary leader and agrarian reformer, born in San Miguel Anenecuilco (now Anenecuilco de los Zapata), in Morelos State. An illiterate tenant farmer of almost pure Indian blood, he recruited an army of Indians from villages and haciendas in Morelos and, under the rallying cry "Land and Liberty", joined the Mexican revolutionist Francisco Indalecio Madero in the 1910 revolt against the Mexican soldier-statesman Porfirio Díaz (qq.v.). Having lost faith in Madero, who assumed the presidency in 1911, Zapata formulated his own agrarian reform plan; known as the Plan of Ayala, it called for the land to be redistributed among the Indians. During the provisional presidencies of the Mexican soldier-politician Victoriano Huerta and, later, the Mexican statesman Venustiano Carranza (qq.v.), Zapata continued his resistance to the government. By this time Zapata had extended his power throughout southern Mexico. With the Mexican revolutionary general Francisco Villa (q.v.) Zapata marched on Mexico City, entering

it the first of three times in 1914. The following year Zapata withdrew to Morelos where, still resisting, he subsequently was murdered by an agent of Carranza. Although regarded as merely a pillaging bandit by his enemies, Zapata was idolized by the Indians as the true revolutionary reformer and hero; his life has inspired countless legends and ballads. See MEXICO: *History: Period of Turmoil*.

ZAPOROZH'YE, city of the Soviet Union, in the Ukrainian S.S.R., and capital of Zaporozh'ye Oblast, on the Dnieper R., 280 miles S.E. of Kiev. A major rail junction and a river transshipment port for Donetz Basin traffic, it is an industrial city, with metallurgical, iron and steel, aluminum, and magnesium plants and locomotive repair shops. Also manufactured are chemicals, agricultural machinery, automobiles, electrical equipment, processed meat, and wire. The city is the site of the first large Russian hydroelectric station, the Dneproges, completed in 1932 and restored in 1947 after World War II. It also has a museum and teachers' and agricultural colleges. Founded in 1770 as Aleksandrovskaya fort on the site of a Zaporozh'ye Cossack stronghold, it became a city in 1806 and was called Aleksandrovsk until 1921. Much of the old section was inundated by the Kakhovka Reservoir, completed in the 1950's. The name is also spelled Zaporozhie or Zaporozhe; the Ukrainian form is Zaporizhzhya. Pop. (1970) 658,000.

ZAPOTEC. See AMERICAN INDIAN LANGUAGES; AMERICAN INDIANS: *Indians of Mexico, Central America, and the West Indies: Southern Mexico and Guatemala*.

ZARIA, city of Nigeria, in Kano State, 90 miles S.W. of the city of Kano. A road and rail hub in a major cotton-growing area, the city trades in cotton, peanuts, hides and skins, ginger, beeswax, and durra sorghum, and has a railroad engineering plant. Industries include cotton ginning, peanut and shea-nut milling, tanning, cottonseed-oil milling, and the manufacture of cigarettes, bicycles, perfumes, and soap. Ahmadu Bello University (1962), a teachers' college, and a leper colony are in Zaria. Founded in the 16th century—some of the old mud walls still surround the city—Zaria became capital of a province of the empire of Songhai (q.v.). The independent emirate, originally founded as one of the original seven Hausa states in the 1st century A.D., was reestablished, but fell to the Fula (q.v.) in the early 19th century and to the British in 1902. Pop. (1971 est.) 200,855.

ZEALAND. See SJAELLAND.

ZEALOTS, in Judaism, those who showed "zeal" (religious fanaticism) on behalf of the

ZEALOTS

Law. Admiration for the zealous individual appears, for example, in a passage in the Old Testament (Num. 25:1-8) that has been dated to the 7th century B.C. In this heroic tale, Phinehas, the grandson of Aaron (q.v.), and thus of the priestly line, kills an Israelite and a Midianite woman whom he has brought into the Israelite camp. As a result, Phinehas delivers the camp from an outbreak of the plague. Phinehas is the prototype of the zealous men to whom Mattathias (see under MACCABEES) appeals for support against the Syrians (1 Mac. 2:27). From this time, in the 2nd century B.C., the term "zealot" was used to characterize individuals active in the resistance against foreign domination of Judea; see JEWS: *Subject Judea*. One such individual was among the disciples of Jesus Christ (see APOSTLE): Simon the Zealot (Luke 6:15). An actual organization of Zealots did not exist, however, until after the Jews rebelled against the Roman government of Palestine in 66 A.D. When the Romans retook Judea in 67-68, an organization that called itself the Zealots was formed by the resistance leaders. According to Josephus (q.v.), the Jewish historian, in *The Jewish War*,

these men gained control of parts of the Temple (see TEMPLE: *Temple at Jerusalem*) and of the city of Jerusalem (q.v.). The Zealots fought with other groups in the population but joined in the defense of the city until its fall in 70.

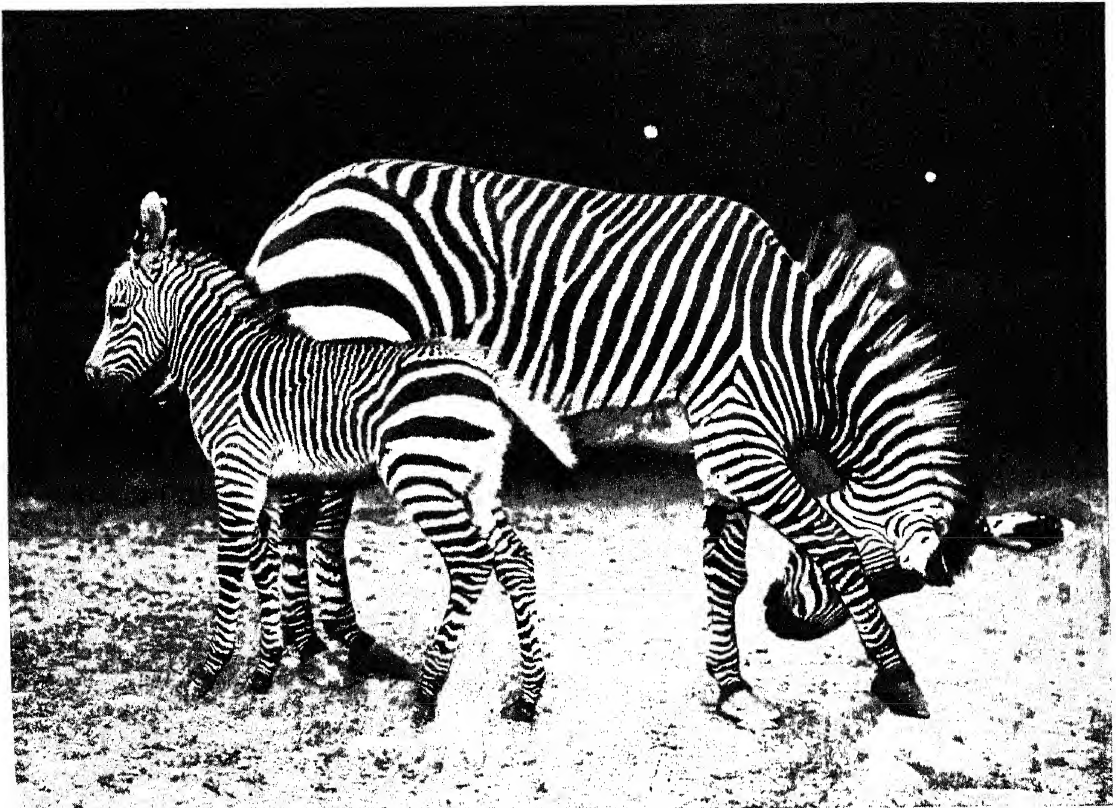
Another group of fanatics that was active in the country during the 1st century A.D. is sometimes confused with the Zealots, that of the Sicarii or Assassins (literally, "dagger men"). The Sicarii were formally organized about 6 A.D. by a man identified only as "Judas of Galilee". They tried to take over Jerusalem in 66 but were defeated. Many were killed, some of them by groups later active in the Zealots, and most of the survivors fled to the fortress of Masada, about 30 miles S.E. of Jerusalem. They held the stronghold until 73, when it was taken by the Romans in a fruitless victory; the defenders had burned the fortress and killed everyone within it.

M.Sm.

ZEBRA, striped mammal native to Africa and belonging to the genus *Equus*, which includes the horse and the ass (qq.v.). The zebra is smaller in size than the horse and greatly resembles the wild ass in habit and form, having a short, erect mane, large ears, and a tufted tail. The stripes, which distinguish this animal from

Mountain zebra, Equus zebra, with offspring.

New York Zoological Society



other members of the Horse family, serve as protective coloration in its natural habitat. The chief enemy of the zebra is the lion, but it is also hunted by African natives for the flesh and hide. Zebras can be trained to work in harness, and are popular animals in zoos and circuses.

Three species and several subspecies are generally recognized, chiefly according to variations in the arrangement of the stripes. The mountain zebra, *E. zebra*, is the smallest species, averaging about 4 ft. high at the shoulders, and has a strong, muscular, and symmetrical body. It is silver white, striped with black markings that extend to every part of the body except the stomach and the inner part of the thighs. The markings on the head are brown, and the muzzle is a rich bay tan. The legs are short and wiry. Mountain zebras travel in small herds and inhabit the mountain ranges of South Africa. This species was formerly numerous, but has been decimated by intensive hunting.

Burchell's zebras, *E. burchelli*, travel in large herds and inhabit the central and eastern plains; the species is named after British naturalist William John Burchell (1782–1863). They are pale yellow with broad, black stripes, generally interspersed with fainter markings called shadow stripes. The species has several variations; some have stripes down to the hoofs, and the lower legs of others are solid white without any stripes. All varieties of Burchell's zebra are called quagga by the Boers. The true quaggas, however, were exterminated during the 19th century; they were darker in color than the zebra and striped only on the head, neck, and shoulders.

The largest species Grévy's zebra, *E. grevyi*, is named after French president François Paul Jules Grévy (q.v.). It attains a height of about 5 ft. at the shoulders, and its stripes are narrow and very numerous. Formerly numerous and of wide range, this species inhabits the arid plains of eastern Africa, but is nearly extinct.

ZEBU, species of domesticated humped cattle, *Bos indicus*, native to southern Asia. It is believed to be a descendant of the banteng (q.v.), the wild ox of Java and Borneo. A large, fatty hump on the back above the shoulders is its most conspicuous characteristic. Most zebus have short horns, pendulous ears, and huge dewlaps. Mild, docile animals, they are used extensively in Africa and Asia as beasts of burden and for their milk and flesh. White bulls are regarded as sacred by certain sects of Hindus; hence, the entire species is known in some parts of the world, notably the United States, as Brahman cattle.

Because the zebu is highly resistant to heat and tropical diseases, it was introduced into the United States and South America for cross-breeding with native cattle to develop strains with similar qualities.

ZEBULUN or **ZABULON**, in the Old Testament, tenth son of the patriarch Jacob (q.v.), the sixth son of his wife Leah (Gen. 30:19–20, 35:23), and eponym of one of the twelve tribes of Israel. Zebulun territory was located apparently in the northern part of Palestine (q.v.) and included the region in which Jesus Christ (q.v.) grew to manhood. The tribe fought fiercely against the Canaanites (q.v.) led by Sisera (Judg. 5:18) and furnished men to the Israelite judge Gideon and to King David (qq.v.). The people of Zebulun appear to have been taken into captivity by the Assyrian king Tiglath-pileser III (r. 745–727 B.C.); see **JEWS: The Kingdom**.

ZECHARIAH, book of the Old Testament (see **BIBLE**), in the King James Version, **ZECHARIAH**. It is one of twelve short prophetic books known, primarily because of their brevity, as the Minor Prophets; see **BIBLE, CANON OF THE**.

Authorship. The first eight chapters are attributed to the postexilic Jewish prophet Zechariah (q.v.). Scholars have dated Zechariah's prophetic ministry to 520–518 B.C. The recording of his prophecies, either by himself or by a disciple, is widely believed to have been completed shortly afterward. Chapters 9–14, which differ from the preceding eight in style, use of language, theology, and historical background, are believed by many scholars to date from the 3rd century B.C., although some date them a century later, and a few believe they were written, in part, before the Babylonian Captivity (q.v.).

Content. The first eight chapters reflect the Persian period, and are concerned with the reconstruction of the Temple and Jerusalem in preparation for a Messianic age; see **ESCHATOLOGY**; see **JEWS: Subject Judea**; **MESSIAH**; **TEMPLE: Temple at Jerusalem**. The text emphasizes individual commitment and obedience, inward spirituality, and a peaceful world in which Jew and Gentile will worship together. These chapters fall into four parts. The first part (1:1–6) is a brief exhortation to repentance. The second part (1:7–6:8) contains oracles in the usual prophetic style intermingled with a series of eight night visions experienced by the prophet in 519 B.C. The visions, which contain much apocalyptic imagery and are interpreted for Zechariah by an angel of the Lord, foretell generally an imminent Messianic age; see **APOCALYPTIC WRITINGS**. The third part (6:9–15) describes the symbolic coronation of a priest who will lead the people in re-

ZECHARIAH

building the Temple. The fourth part (chapters 7–8) consists of oracles describing the conditions expected to prevail in a restored Jerusalem.

The remaining six chapters of Zechariah constitute one of the most obscure portions of the Old Testament. They are believed to reflect the Greek period (see *MACCABEES*), are made up mainly of apocalyptic oracles with numerous allusions that no longer are clearly understood by scholars, and are concerned generally with elaboration of earlier themes. Chief among these themes are the restoration of Israel (q.v.) after the defeat of Israel's enemies (chapters 9–11); the advent of the Messiah; and the coming great Day of the Lord, when the covenant (q.v.) will be reestablished, and the God of Israel will be universally worshiped. The tone of these chapters is despairing, and a greater emphasis is placed on supernatural intervention as the sole possible means of the long-delayed but still-expected salvation from Gentile oppression.

Christians attach special significance to several passages in the last six chapters. They regard them as prophecies later fulfilled by Jesus Christ (q.v.). Thus Zech. 9:9 is believed to pertain to Jesus' triumphant entry into Jerusalem; Zech. 9:10 to His universal reign; Zech. 11:12 to Jesus' betrayal for thirty pieces of silver; Zech. 12:10 and 13:6 to the wounds suffered by Jesus; and Zech. 13:7–9 to Jesus as the Good Shepherd smitten for the sheep.

ZECHARIAH (fl. 6th century B.C.), Old Testament prophet (see *PROPHECY*) and author of the first eight chapters of the book that bears his name, one of the so-called Minor Prophets; see *book of ZECHARIAH*. The son of a priest called Iddo (Ezra 5:1, 6:14), Zechariah was a priest (Neh. 12:12, 16) who had returned from exile in Babylon; see *BABYLONIAN CAPTIVITY*. The first verse of Zechariah states that the author was the "son of Berechiah", but this is thought to be a mistaken interpolation from Isa. 8:2. The Persian king Darius I (see *under DARIUS*), to whom Judah was subject, permitted the Jews to restore the Temple, but they lagged in this undertaking, and Zechariah joined with the prophet Haggai (q.v.) to spur them on; see *TEMPLE: Temple at Jerusalem*.

ZEDEKIAH, original name *MATTANIAH* (d. after 586 B.C.), last king of Judah (597–586) and final ruler of the line of David (q.v.); see *JEWS: The Kingdom: The Fall of Jerusalem to Nebuchadnezzar*; *JUDAH*. He was placed on the throne by the Chaldean king Nebuchadnezzar II (see *under NEBUCHADNEZZAR*) after the latter had defeated and deposed Jehoiachin (615?–560? B.C.),

Zedekiah's nephew; see *BABYLONIA: History*. As the puppet king of an enslaved people, Zedekiah's position was extremely weak; he vacillated between the policy of the prophet Jeremiah (q.v.), who urged continued submission to Chaldea, and that of the Jewish patriots who urged rebellion. He yielded finally to the urgings of the patriots and plotted with Egypt against Chaldea. In 588 he broke his oath of allegiance to Nebuchadnezzar and took up arms against him. Jerusalem was soon besieged by the Chaldean army. The Egyptians made a half-hearted effort to come to Zedekiah's aid, but to no avail. Jerusalem fell in 586, after withstanding the Chaldeans for almost two years. Zedekiah was captured, brought before Nebuchadnezzar, forced to witness the execution of his sons, and then blinded. Carried in chains to Babylon, he was imprisoned there for the rest of his life. Zedekiah's story is told in the Old Testament books of Kings, Chronicles, and Jeremiah (qq.v.).

ZEEMAN, Pieter (1865–1943), Dutch physicist, born in Zonnemaire, and educated at the University of Leiden. He taught at Leiden from 1890 until 1900, when he became professor of physics at the University of Amsterdam. In 1896, Zeeman discovered that the spectral lines of a light source subjected to a strong magnetic field were split into several components, each of which was polarized. This phenomenon, known as the Zeeman effect, confirmed the electromagnetic theory of light, and was used to study the magnetic fields of stars (q.v.). Zeeman shared the 1902 Nobel Prize in physics with the Dutch physicist Hendrik Antoon Lorentz (q.v.) for their joint research into the influence of magnetism upon radiation (qq.v.).

ZEFAT, or *SAFAD* or *SAFED*, town in Israel, in the Galilee region, 30 miles N.E. of Haifa. It is a summer resort and artists' colony. In the 16th century it became a center of cabalistic learning, retaining this position well into the next century; see *CABALA*. Earthquake and plague reduced the population severely in the 18th century, but it was resettled in the last quarter of that century. Zefat was again damaged by an earthquake in 1837. Pop. (1972 est.) 13,600.

ZEISS, Carl (1816–88), German manufacturer of optical instruments, born in Weimar. He studied medicine, then in 1846 opened a shop in which he produced and repaired optical equipment for the University of Jena. Initially he specialized in the manufacture of microscopes. In 1866 he invited Ernst Karl Abbe (1840–1905), a German mathematician and physicist, to be his director of research; Abbe, who made outstand-

ing contributions to the design of optical instruments, became Zeiss' partner in 1875. The Zeiss workshop soon acquired a worldwide reputation for the manufacture of high-quality optical equipment, particularly cameras and microscopes. After Zeiss' death, Abbe became sole owner of the firm, established international branch offices, and set up the Carl Zeiss Foundation for Research. The Zeiss factory and glassworks are now in Oberkochen and Mainz, West Germany.

ZELAYA, José Santos. See NICARAGUA: *History*.
ZEN or **CH'AN**, school of Buddhism (q.v.) which developed in China and later in Japan as the result of a fusion between the Mahayana form of Buddhism originating in India and the Chinese philosophy of Taoism (q.v.); see CHINESE PHILOSOPHY. Zen and Ch'an are respectively the Japanese and Chinese ways of pronouncing the Sanskrit term "Dhyana", which designates a state of mind roughly equivalent to contemplation or meditation, although without the static and passive sense that these words sometimes convey. Dhyana denotes specifically the state of consciousness of a Buddha, one whose mind is free from the assumption that the distinct individuality of himself and other things is real. All schools of Buddhism hold that separate things exist only in relation to one another; this relativity of individuals is called their "voidness" (Skr. *sunyata*), which means not that the world is truly nothing, but that nature cannot be grasped by any system of fixed definition or classification. Reality is the "suchness" (Pali *tathatā*) of nature, or the world "just as it is" apart from any specific thoughts about it. See also RELIGION: *The Ways of Liberation: Hinduism; Buddhism; Taoism*.

Doctrines and Practices. Zen is the peculiarly Chinese way of accomplishing the Buddhist goal of seeing the world just as it is, that is, with a mind in which there are no grasping thoughts or feelings (Skr. *trishna*). This attitude is called "no-mind" (Chin. *wu-hsin*), a state of consciousness wherein thoughts move without leaving any trace. Unlike other forms of Buddhism, Zen holds that such freedom of mind cannot be attained by gradual practice but must come through direct and immediate insight (Chin. *tun-wu*; Jap. *satori*). Thus Zen abandons both theorizing and systems of spiritual exercise and communicates its vision of truth by a method known as "direct pointing". Its exponents answer all philosophical or religious questions by nonsymbolic words or actions; the answer is the action just as it is, and not what it represents. Typical is the reply of the Zen master

Yao-shan, who, on being asked "What is the Way (of Zen)?" answered, "A cloud in the sky and water in the jug!" Zen students prepare themselves to be receptive to such answers by sitting in meditation (Jap. *za-zen*) while they simply observe, without mental comment, whatever may be happening.

Sects. The two main sects of Zen are Rinzai Zen and Soto Zen. The Soto seems to put more emphasis on the discipline of *za-zen*, while the Rinzai sect makes use of meditation-problems (Jap. *koan*) based on the dialogues (Jap. *mon-do*), similar to the example mentioned previously, between the old masters and their students. The student is expected to present his understanding of an incident to his teacher, in some nonverbal direct form (by pointing, for example), in a private interview called in Japanese *sanzen*.

Influence on Arts and Crafts. Zen is studied ordinarily in semimonastic communities to which laymen are admitted for limited periods. However, the Zen monastery is more strictly a training school combining meditation with a considerable amount of manual labor. The students in such schools give special attention to the arts and crafts, notably painting, calligraphy, gardening, architecture, and ceremonial tea drinking. In Japan the arts of fencing, archery, and jujitsu (q.v.) are also pursued.

Zen has had a strong influence upon Far Eastern arts and crafts because its point of view is connected with action rather than theory and with direct vision of nature rather than interpretation. According to Zen the mind serves properly as a window glass rather than as a reflector, that is, the mind should give an immediate view instead of an interpretation of the world. All theories of nature and reality are considered to interfere with this direct vision. Zen thereby shows its continuity with the original idea of the Indian philosopher and founder of Buddhism Gautama Buddha that suffering is the result of grasping desire, for it considers that the mind and feelings frustrate their own proper functioning when they cling deliberately to the world of experience; see BUDDHA. Thus the subject matter of Zen religious painting consists of natural forms, such as birds, grasses, rocks, and mountains, presented merely as images in a style that combines a maximum of technique with a minimum of planning and deliberation. Such art avoids iconography (illustration or representation by visual means, such as pictures) and expresses a way of experiencing rather than ideas based upon experience, for Zen is not committed to any system of doctrine or belief.

History. According to tradition Zen was introduced into China at some time before 520 A.D. by the Indian Buddhist monk Bodhidharma (d. about 530 A.D.). The most important figures in Zen's early development, which is distinctively Chinese, were Hui-neng (638–713), Te-shan (780–865), and Lin-chi (d. 867). Chinese black-ink painting during the Sung dynasty (960–1280) became one of the finest artistic expressions of the Zen school; see CHINESE ART.

The two main sects of Zen were brought to Japan by Japanese who had studied in China. The Buddhist monk Eisai (1141–1215) introduced Rinzai Zen in 1191 and the Buddhist monk Dogen (1200–53) introduced Soto Zen in 1227. Both sects flourish in Japan at the present time. With the development of the school in Japan, such painters as Sesshu (about 1419–1506), Sesson (1504–89), and Jasoku (d. 1483) expressed the Zen view of nature directly in their work. Under Zen influence the Japanese brought the art of ceremonial tea drinking to a high degree of refinement and developed also a distinctive kind of poetry in the brief verse form, haiku (q.v.). See JAPANESE ART AND ARCHITECTURE; JAPANESE LITERATURE: *Edo Period*.

Western interest in Zen dates from the publication of the first authoritative account of the subject in English, *Essays in Zen Buddhism* by the Japanese scholar Daisetz T. Suzuki (1870–1966). After World War II and the occupation of Japan a great interest in Zen developed in Europe and the United States, notably among artists, philosophers, and psychologists. It had a special appeal for abstract and nonobjective painters and sculptors; see ART: *The Modern Period*. Philosophers have noted its affinities with the thought of the Austrian philosopher Ludwig Wittgenstein (1889–1951), with the theory of general semantics (q.v.) of the American scientist and writer Alfred Habdank Skarbek Korzybski (1879–1950), and to some extent with existentialism (q.v.) as propounded by the German philosopher Martin Heidegger (q.v.). Among the standard works on the subject are *Introduction to Zen* (1934) by Suzuki; *Way of Zen* (1957) by Alan Watts; *Oriental Classics* (1960) by R. H. Blyth; *The World of Zen* (1960) edited by Nancy Wilson Ross; and *A History of Zen Buddhism* (1963) by Heinrich Dumoulin, S.J. A.W.W.

ZEND-AVESTA. See AVESTA.

ZENGER, John Peter (1697–1746), German-American printer and journalist, born in The Palatinate (now in Bavaria), Germany. He emigrated to America in 1710, and from 1711 to 1719 was an apprentice to William Bradford (q.v.), royal printer for the colony of New York. They

became partners in 1725, and the following year Zenger opened his own printing establishment. In 1730 he printed the first arithmetic textbook ever published in the colonies.

Three years later, Zenger founded the *New York Weekly Journal*, a newspaper backed by a group of influential local figures. Zenger printed his backers' articles criticizing the colonial governor of New York, and on Nov. 17, 1734, he was arrested and imprisoned on charges of seditious libel. The Scottish-American lawyer Andrew Hamilton (q.v.) defended Zenger during the trial, which took place in 1735. Hamilton eloquently argued that the anti-administration allegations printed in the *Journal* were true and therefore not libelous. Despite the contrary opinion of the judge, the jury accepted Hamilton's thesis and declared Zenger not guilty. This verdict is considered the first milestone in the history of American freedom of the press. Zenger was appointed public printer for the colonies of New York and New Jersey in 1737 and 1738, respectively.

See also LIBEL; PRESS, FREEDOM OF THE.

ZENO or ZENON (about 426–91), Emperor of the Eastern Roman Empire (474–91), born in Isauria, Asia Minor. Zeno married the daughter of Emperor Leo I (400?–74) in 468, reigned briefly in 474 as coemperor with their son Leo II (d. 474), and became sole emperor later the same year. As the result of a rebellion led by his wife's uncle Basiliscus (d. 478), Zeno was expelled from Constantinople in 475. He suppressed the revolt in 476 with the aid of the Ostrogothic leader Theodoric (q.v.). In an attempt to end the religious strife resulting from the activities of the Monophysites (q.v.), Zeno issued in 482 the *Henoticon*, an edict designed to unify the contending factions. Rejection of the *Henoticon* by Pope Felix II (see under FELIX) precipitated the first great schism (484–519) between the eastern and western divisions of the Church. In 488, in order to rid the Eastern Empire of the turbulent Ostrogoths, Zeno encouraged their leader Theodoric to invade Italy. See GOTHS: *Ostrogoths*. G.E.D.

ZENO (fl. 5th cent. B.C.), Greek mathematician and philosopher of the Eleatic School (q.v.), born in Elea, in southwestern Italy; see PHILOSOPHY: *Greek Philosophy: The Eleatic School*. He became a favorite disciple of the philosopher Parmenides (q.v.), and accompanied him to Athens at the age of about forty. In Athens Zeno taught philosophy for some years, concentrating on the eleatic system of metaphysics (q.v.). The Athenian statesmen Pericles (q.v.) and Callias studied under him. Zeno later returned to Elea

John Peter Zenger's appeal to uphold freedom of the press, published in his New-York Weekly Journal. Bettmann Archive

THE New-York Weekly JOURNAL

Containing the freshest Advices, Foreign, and Domestic.

MUNDAY November 12, 1733.

Mr. Zenger.

Insert the following in your next,
and you'll oblige your Friend,

CATO.

*Mira temporum felicitas ubi sentiri que
velis, & que sentias dicere licet.*

Tacit.

THE Liberty of the Press is a Subject of the greatest Importance, and in which every Individual is as much concern'd as he is in any other Part of Liberty: therefore it will not be improper to communicate to the Publick the Sentiments of a late excellent Writer upon this Point. Such is the Elegance and Perspicuity of his Writings, such the inimitable Force of his Reasoning, that it will be difficult to say any Thing new that he has not said, or not to say that much worse which he has said.

There are two Sorts of Monarchies, an absolute and a limited one. In the first, the Liberty of the Press can never be maintained, it is inconsistent with it; for what absolute Monarch would suffer any Subject to animadvert on his Actions, when it is in his Power to declare the Crime, and to nominate the Punishment? This would make it very dangerous to exercise such a Liberty. Besides the Object against which those Pens must be directed, is

their Sovereign, the sole supream Magistrate; for there being no Law in those Monarchies, but the Will of the Prince, it makes it necessary for his Ministers to consult his Pleasure, before any Thing can be undertaken: He is therefore properly chargeable with the Grievances of his Subjects, and what the Minister there acts being in Obedience to the Prince, he ought not to incur the Hatred of the People; for it would be hard to impute that to him for a Crime, which is the Fruit of his Allegiance, and for refusing which he might incur the Penalties of Treason. Besides, in an absolute Monarchy, the Will of the Prince being the Law, a Liberty of the Press to complain of Grievances would be complaining against the Law, and the Constitution, to which they have submitted, or have been obliged to submit; and therefore, in one Sense, may be said to deserve Punishment. So that under an absolute Monarchy, I say, such a Liberty is inconsistent with the Constitution, having no proper Subject in Politics, on which it might be exercis'd, and if exercis'd would incur a certain Penalty.

But in a limited Monarchy, as England is, our Laws are known, fixed, and established. They are the straight Rule and sure Guide to direct the King, the Ministers, and other his Subjects: And therefore an Offence against the Laws is such an Offence against the Constitution as ought to receive a proper adequate Punishment; the severa

Constit

and, according to traditional accounts, joined a conspiracy to rid his native town of the tyrant Nearchus; the conspiracy failed and Zeno was severely tortured, but he refused to betray his accomplices. Further circumstances of his life are not known.

Philosophy. Very few fragments of Zeno's works remain, but the writings of the Greek philosophers Plato and Aristotle (qq.v.) provide tex-

tual references to Zeno's writings. Philosophically, Zeno accepted Parmenides' belief that the universe, or being, is a single, undifferentiated substance, a oneness, though it may appear diversified to the senses. Zeno's intention was to discredit the senses, which he sought to do through a brilliant series of arguments or "paradoxes" on time and space that have remained complex intellectual puzzles to this day. A typi-

cal paradox asserts that a runner cannot reach a goal because, in order to do so, he must traverse a distance; but he cannot traverse that distance without first traversing half of it, and so on, ad infinitum. Because an infinite number of bisections exist in a spatial distance, one cannot travel any distance in finite time, however short the distance or great the speed. This argument, like several others of Zeno, is intended to demonstrate the logical impossibility of motion. In that the senses lead us to believe in the existence of motion, the senses are illusory and therefore no obstacle to accepting the otherwise implausible theories of Parmenides. Zeno is noted not only for his paradoxes, but for inventing the type of philosophical argument they exemplify. He has thus been named the inventor of dialectical reasoning by Aristotle. See also LOGIC.

ZENO (fl. late 4th and early 3rd cent. B.C.), Greek philosopher, born in Citium, Cyprus. Little is known of his early life except that his contemporaries referred to him as a Phoenician. He was a student of the 4th-century Cynic philosopher Crates of Thebes (see CYNICISM) and of the Platonist Xenocrates (396–314 B.C.). About 300 Zeno founded his own school of philosophy, known as Stoicism (q.v.). The name of the school was derived from *Stoa Poikilē* ("Painted Porch"), the name given to the public portico where the master taught his disciples. Moral obligation, self-control, and living in harmony with nature were some of the principles of practical ethics with which Zeno was chiefly concerned. He taught in Athens for more than fifty years and was publicly honored for his upright manner of living. It is said, however, that he refused the offer of Athenian citizenship out of loyalty to his native Cyprus. Zeno left no written accounts of his teachings, but they were transmitted by his many disciples.

ZENOBIA (fl. 3rd cent. A.D.), Queen of Palmyra, wife of King Odenathus (d. 266?), born in Palmyra (now Tadmor, Syria). Following the assassination of her husband, in which she is believed to have been implicated, Zenobia succeeded to power as regent for their young son. Within three years she extended her rule to all of Syria, to Egypt, and to most of Asia Minor, ostensibly in alliance with Rome. In 271, however, because of Zenobia's aggressiveness in the East, the Roman emperor Lucius Domitius Aurelianus (q.v.) took up arms against her. After gaining control of nearly all of Zenobia's domain, Aurelianus besieged the city of Palmyra. It fell and Zenobia was captured and taken to Rome. Later she was given an estate at Tibur (now Tivoli,

Italy), where she spent the rest of her life in pensioned retirement. A beautiful and brilliant woman, Zenobia is also remembered for her ruthless ambition.

ZEOLITE (Gr. *zein*, "to boil"; *lithos*, "a stone"), large group of minerals composed of hydrous aluminum silicates, and having sodium and calcium, and sometimes potassium (qq.v.) as the main bases; see SILICON. The zeolites are so named because of their swelling and bubbling under high temperature. The minerals range in hardness from 3½ to 5½ and have sp.gr. of 2.0 to 2.4. Zeolites are usually found in veins and cavities of basic igneous rocks (q.v.). Among the more common zeolites are stilbite, chabazite, natrolite, and analcime, which are widely distributed. Zeolites are used as water-softening agents in an ion-exchange method called zeolite process; see WATER: Purification; WATER SUPPLY AND WATERWORKS: Treatment.

ZEPHANIAH, book of the Old Testament (see BIBLE), in the King James Version, ZEPHANIAH; in the Douay Version, THE PROPHECY OF SOPHONIAS. It is one of the twelve short prophetic books of the Old Testament known, chiefly because of their brevity, as the Minor Prophets; see BIBLE, CANON OF THE.

Authorship. Tradition has attributed it entirely to the Hebrew prophet Zephaniah (q.v.), but a number of modern scholars regard various sections of the book, notably in chapters 2–3, as later additions. According to the superscription (1:1), the prophecy was uttered in the reign of the Judean king Josiah (q.v.). Practices and beliefs that Josiah sought to reform in 621 are condemned; and a reference is made to a northern menace, presumably the barbarous Scythians (q.v.), who threatened to overrun the Middle East about 625 B.C.

Content. The prophecy is in three parts. In the first part (1:1–2:3), all of Judah (q.v.) is condemned to destruction for defiling the worship of the Lord through practice of certain foreign religious rites, in particular, rites peculiar to the Assyrian-Babylonian religion, for adopting foreign customs, and for violent and deceitful behavior; see BABYLONIAN RELIGION. An imminent Day of the Lord is predicted, and Judah is urged to repent, so that the Lord's fierce anger may be turned away from her. In the second part (2:4–15), judgment and destruction are prophesied for enemy nations. Philistia, Moab, Ammon, Ethiopia, and Assyria will be brought low, given over to the sword, and left desolate because they have been arrogant and have ill-treated Judah. In the third part (chapter 3), Jerusalem specifically is condemned to destruction on the

Day of the Lord for refusing to change her corrupt ways. The Gentile nations will be converted, and a faithful, righteous remnant of Judah will be saved and become renowned again among the peoples of the world (3:9–20).

The section of the book now commonly agreed upon as a later addition is 3:14–20, a psalmlike passage praising God for the future glorious restoration of the remnant of Judah. Zephaniah's oracle on the terrible Day of the Lord (1:14–18) inspired a famous medieval Christian hymn, the *Dies Irae* (Lat., "Day of wrath"), now a part of the Requiem mass; see REQUIEM.

ZEPHANIAH (fl. 7th century B.C.), Old Testament prophet (see PROPHECY) who purportedly wrote the book that bears his name, one of the so-called Minor Prophets: see book of ZEPHANIAH. His ancestry is traced in the first verse of the book to Hezekiah (q.v.), King of Judah. Zephaniah lived apparently in Jerusalem during the reign of Josiah (q.v.), King of Judah. The political and religious corruption that he describes indicates that his prophecy preceded Josiah's reforms, which were instituted about 621 B.C. Scholars generally agree, however, that some passages in the book are later additions.

ZEPHYR LILY, common name applied to herbs of the genus *Zephyranthes*, belonging to the Amaryllis family, Amaryllidaceae. The genus, known also as the fairy lily, is native to the warmer regions of America. More than fifty species exist, many of which are popular in window and outdoor gardens. The plants are bulbous, and during the winter require considerable moisture as well as protection from frost. Zephyr lilies have narrow, elongated leaves. The flowers are solitary and erect, and are borne on a slender, hollow stalk.

The most common zephyr lily, *Z. atamasco*, a native of the southeastern United States, has large white flowers. As this species blooms in the spring, it is often called the Easter lily. Other popular species include *Z. candida*, which blooms in autumn and bears pure-white flowers sometimes tinged with rose; *Z. grandiflora*, with rose-colored flowers blooming in autumn; and *Z. carinata*, with rosy flowers blooming in summer.

ZEPHYRUS, in Greek mythology, the god of the west wind. He was the son of the Titan Astraeus and of Eos, the goddess of the dawn (see TITANS). Zephyrus was said to be the husband of Iris (q.v.), the goddess of the rainbow and a messenger of the gods. His brothers were Boreas and Notus, the gods of the north and south winds, respectively.

ZEPPELIN, Count Ferdinand von (1838–1917), German military officer and inventor, born in Konstanz, and educated at the Ludwigsburg Military Academy and the University of Tübingen. He entered the Prussian army in 1858 and went to the United States in 1863, during the American Civil War, to work as a military observer for the Union army. Zeppelin served in the Franco-German War (q.v.) of 1870–71, and when he retired in 1891, he had reached the rank of brigadier general.



Count Ferdinand von Zeppelin

Zeppelin took keen interest in balloon (q.v.) flight and devoted himself to the design and construction of airships; see AIRSHIP. The first of the many rigid dirigibles (with an aluminum frame), called Zeppelins in his honor, was completed in 1900. He continued his research despite many setbacks, and in 1910, a Zeppelin provided the first commercial air service for passengers. During World War I, Zeppelins were used in German air raids over England and Belgium, but were found to be extremely vulnerable to antiaircraft fire, and the Zeppelin was soon superseded by the airplane (q.v.).

ZERNIKE, Frits (1888–1966), Dutch physicist, born in Amsterdam, and educated at the University of Amsterdam. He was professor of physics at the University of Groningen from 1920 to 1958. During a leave from that university in 1947 he was visiting professor at Johns Hopkins University in Baltimore, Md. Zernike is best known

ZERO

for his invention, in 1932, of the phase contrast microscope, an optical instrument which made possible the detailed study of living cells. For this contribution to microscopy he was awarded the 1953 Nobel Prize in physics. See MICROSCOPE: *Special Microscopes*.

ZERO, term applied to the number (q.v.) representing naught, denoted by the symbol 0. The fundamental arithmetic properties of the number 0 are: $a + 0 = a$, $a - 0 = a$, and $a \times 0 = 0$, in which a is any number; and $0 \div b = 0$, in which b is any number other than 0. Division by 0 is not defined and therefore is an inadmissible operation. See also EXPONENT. In the real-number system, 0 is the only number that is neither negative nor positive, and it represents the boundary between the negative and the positive numbers. This property makes 0 the natural starting point, or origin, on many scales, as on the coordinate axes and on thermometers.

In the development of written notation, a symbol for zero was evolved long after symbols for the other numbers were invented. The Babylonians used written symbols for numbers thousands of years before the advent of a symbol for zero. Zero was introduced initially, not as a number to be used in computation, but as a position marker to distinguish between such numbers as 123, 1203, 1230, and 1023. The Maya, about the 1st century A.D., used a small oval containing an inner arc to denote zero. About five centuries later the Hindus began to utilize a circle or a dot within a circle as a symbol for zero; they wrote numbers in columns corresponding to the wires of an abacus (q.v.), and used the zero to represent a blank column. The Hindu word for zero was *śūnya*, meaning empty, or void; this word, translated and transliterated many times, is the root origin of the English words "cipher" and "zero". See NOTATION; NUMERALS.

ZERO, ABSOLUTE. See ABSOLUTE ZERO.

ZERUBBABEL (fl. 6th cent. B.C.), prince of Judah and governor of Jerusalem, born probably in Babylon during the Babylonian Captivity (q.v.). A grandson of Jehoiachin, King of Judah (615?–560? B.C.), he was a direct descendant of King David (q.v.; Ezra 2:2, Hag. 1:1). When King Cyrus the Great (q.v.) of Persia permitted the captive Jews in Babylon to return to Judah (about 538 B.C.), Zerubbabel led the first contingent, numbering some 42,000. Cyrus appointed him (Hag. 1:14) secular governor of Jerusalem. There he organized the rebuilding of the Temple, which had been destroyed in 586 B.C. by the Chaldean king Nebuchadnezzar II (see under NEBUCHADNEZZAR); see TEMPLE: *Temple at Jerusa-*

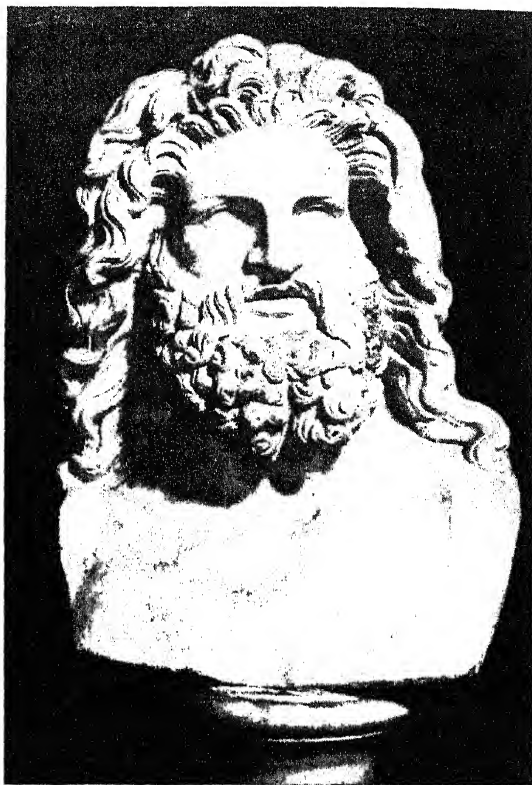
lem. The remainder of Zerubbabel's life is obscure; tradition indicates that he resigned his post and returned to Babylon.

ZETHUS. See NIOBE.

ZETLAND. See SHETLAND ISLANDS.

ZEUS, in Greek mythology, the god of the sky and ruler of the Olympian gods. Zeus corresponds to the Hindu god Dyaus (see INDIAN MYTHOLOGY) and the Roman god Jupiter (q.v.). The Romans identified Jupiter with Zeus, assigning to their own god many of the attributes and myths of the Greek divinity.

Zeus was considered the father of the gods and men. He did not create either gods or men;



Zeus

he was their father in the sense of being the protector and ruler both of the Olympian family and of the human race. He was lord of the sky, the rain-god, who performed an obviously important function in sunny Greece, and the cloud-gatherer, who wielded the terrible thunderbolt. His breastplate was the aegis, his bird the eagle, his tree the oak. Zeus presided over the gods on Mt. Olympus (see OLYMPUS) in Thessaly, and his principal shrines were at Dodona, the land of the oak trees and the most ancient shrine, famous for its oracle, and at Olym-

pia (qq.v.), where the Olympian Games (q.v.) were celebrated in his honor every fourth year. The Nemean games, held at Nemea, northwest of Argos, were also dedicated to Zeus.

Zeus was the youngest son of the Titans (q.v.) Cronus and Rhea (qq.v.), and the brother of the deities Poseidon, Hades, Hestia, Demeter, and Hera (qq.v.). According to the ancient myth, Cronus, fearing that he might be dethroned by one of his children, swallowed them as they were born. Upon the birth of Zeus, Rhea wrapped a stone in swaddling clothes for Cronus to swallow and concealed the infant god in Crete, where he was fed on the milk of the goat Amalthea and reared by nymphs. When Zeus grew to maturity, he forced Cronus to disgorge the other children, who were eager to take vengeance on their father. In the war that followed, the Titans fought on the side of Cronus, but Zeus and the other gods were successful, and the Titans were consigned to the abyss of Tartarus (q.v.). Zeus henceforth ruled over the sky, and his brothers Poseidon and Hades were given power over the sea and the underworld, respectively. The earth was to be ruled in common by all three.

Beginning with the writings of the Greek poet Homer (q.v.), Zeus is pictured in two very different ways. On the one hand, he is represented as the god of justice and mercy, the protector of the weak, and the punisher of the wicked. As husband to his sister Hera, he is the father of Ares, the god of war; Hebe, the goddess of youth; Hephaestus (qq.v.), the god of fire; and Eileithyia, the goddess of childbirth. At the same time, Zeus is described as falling in love with one woman after another and resorting to all kinds of tricks to hide his infidelity from his wife. Stories of his escapades were numerous in ancient mythology and many of his offspring were a result of his love affairs with other goddesses and with mortal women. It is believed that, with the development of a sense of ethics in Greek life, the idea of a lecherous, sometimes ridiculous father god became distasteful, and consequently, later legends tended to present Zeus in a more exalted light. Tales of his infidelity were purported to reflect the sacred marriage of the earth and the sky. His many affairs with mortals are also explained as the wish of the early Greeks to trace their lineage to the father of the gods.

ZHDANOV, formerly MARIUPOL, city of the Soviet Union, in the Ukrainian S.S.R., at the mouth of the Kal'mius R. on the Sea of Azov, 60 miles n.w. of Taganrog. It is an important railroad terminus and industrial and export center,

with large steel mills, shipyards, chemical plants, clothing factories, and fish canneries. Grain, coal, iron ore, salt, and oil cake are shipped from the port. The city is possibly the site of an ancient Greek colony, but the modern settlement was founded in 1779 by Crimean Greeks. It was heavily damaged during World War II and was occupied by the Germans from 1941 until 1943. In 1948 the city was renamed in honor of the Soviet leader Andrei Aleksandrovich Zhdanov (1896–1948). Pop. (1970) 417,000.

ZHITOMIR, city of the Soviet Union, in the Ukrainian S.S.R., and capital of Zhitomir Oblast, on the Teterev R., 85 miles w. of Kiev. It is a transportation center and an important market for lumber and grain. The industrial establishments include distilleries and furniture, food-processing, clothing, and metalworking factories. Among the cultural institutions are a teachers college and several libraries. Zhitomir was founded in the 9th century. Because of its position on the trading route between Scandinavia and Constantinople (now Istanbul), the city soon became a flourishing commercial center. In later times it was sacked by Tatars and held successively by Lithuania and Poland. It was incorporated into Russian territory in 1778. German troops occupied the city during the war from August, 1941, until December, 1943. Pop. (1970) 161,000.

ZHUKOV, Georgi Konstantinovich (1896–1974), Soviet military officer, born near Moscow. He served in the Russian imperial army during World War I, joined the Red Army in 1918, and fought as a cavalry commander in the Russian civil war. After the war he studied armored warfare at the Frunze Military Academy. In 1939, using tanks, he was victorious during the Soviet-Japanese clashes on the Manchurian border; the following year he was made a chief of staff while fighting in the Russo-Finnish War. During World War II (q.v.) Zhukov commanded the defense of Moscow; he was involved in most other important Soviet battles and led the final attack on Berlin. A marshal since 1943, he remained in Germany to head the Soviet occupation forces. Shortly after his triumphant return to Moscow in 1946, he was demoted to a regional post by Premier Joseph Stalin (q.v.), who resented the marshal's prestige. Following Stalin's death in 1953, Zhukov became first deputy minister of defense. He was named minister of defense in 1955 and a member of the executive committee of the Communist Party in July, 1957; three months later he was dismissed from both offices for allegedly giving military affairs priority over party concerns. *Marshal*

ZIEGFELD

Zhukov's Greatest Battles, an English translation of articles by Zhukov that appeared in Soviet periodicals between 1965 and 1968, was published in 1969; the first American edition of *The Memoirs of Marshal G. Zhukov* was published in 1971.

See UNION OF SOVIET SOCIALIST REPUBLICS: *History*.

ZIEGFELD, Florenz (1869–1932), American theatrical producer, born in Chicago, Ill., and educated there in the public schools. He promoted musical attractions at the Chicago World's Columbian Exposition of 1893 and later managed a number of entertainers, including the American comedians Fanny Brice and W. C. Fields (qq.v.), who, under his direction, became stars.

With *The Follies of 1907*, produced in New York City, Ziegfeld introduced the revue to the American musical stage. Famous for their beautiful chorus girls and extravagant, dazzling sets, the highly successful revues became known as "The Ziegfeld Follies". Ziegfeld also produced traditional musical shows, including *Show Boat* (1927), by the American composer Jerome Kern and the American librettist Oscar Hammerstein 2nd, and *Bitter Sweet* (1929), by the British playwright and composer Noël Coward (qq.v.).

ZIEGLER, Karl (1898–1973), German chemist, born near Kassel (now in West Germany). He was educated at the University of Marburg and taught at the universities of Marburg, Heidelberg, and Halle-Saale. In 1943 he was made director of the Max Planck Institute (formerly Kaiser Wilhelm Institute) for Coal Research, Mülheim an der Ruhr. Ziegler shared the 1963 Nobel Prize in chemistry with the Italian chemist Giulio Natta (q.v.). Both men were cited for their development of plastics and other synthetics of commercial importance. Ziegler's experiments in plastics led to the development of catalysts that provide the plastics with greater uniformity, hardness, strength, and resistance to heat.

ZIMBABWE, ruins of a large fortified town located about 15 miles S.E. of Fort Victoria, Zimbabwe, formerly Rhodesia. The newly independent nation was named for the town.

The ruins at Zimbabwe include two principal structures. One, an elliptical walled enclosure 832 ft. in diameter called the "temple", contains vestiges of a building used probably for religious purposes. The enclosing wall is in places 32 ft. high and 14 ft. thick. Two solid conical towers, one 34 ft. high, are at the S. end of the wall. The other principal structure is a ruined fort on a nearby hill called the "acropolis". Zimbabwe was first visited by a German expedition

in the 1870's and was excavated in 1891 by the British archeologist James Theodore Bent (1852–97), who advanced the theory that Zimbabwe is the remains of a city of ancient Ophir, the country in which, according to the Bible, King Solomon's mines were located. Bent's theory was rejected in 1905 by the British archeologist David Randall-MacIver (1873–1945) and conclusively disproved in 1929 by the British archeologist Gertrude Caton-Thompson (1888–) who identified the stonework as a type of construction developed by local Bantu tribes during the 14th and 15th centuries. Other authorities believe that Zimbabwe was a gold-distributing center during the Middle Ages (q.v.). See RHODESIA: *History*.

ZIMBABWE, Republic of. See RHODESIA.

ZIMBALIST, Efrem (1889–), American violinist and composer, born in Rostov, Russia, and educated at the Imperial School, Saint Petersburg (now Leningrad), where he studied under the Hungarian violinist Leopold Auer (q.v.). Zimbalist made a sensational debut at the age of eighteen in Berlin, Germany. After successfully touring Europe he migrated to the United States in 1911 and made his American debut with the Boston Symphony Orchestra. One of the most admired violinists of the 20th century, he performed in the leading cities of the world. Among his best-known compositions are *American Rhapsody* (1936; rev. 1943) and the opera *Landara* (1956). In 1928 Zimbalist began to teach at the Curtis Institute of Music, Philadelphia, Pa.; he served as director of the institute from 1941 to 1968.

ZINC, metallic element with at.no. 30, at.wt. 65.38, b.p. 911° C. (1671.8° F.), m.p. 419.5° C. (787.1° F.), sp.gr. 7.13^{20°}, and symbol Zn. It ranks twenty-sixth in abundance among the elements in the crust of the earth. The ores of the metal have been widely known since prehistoric times, but zinc was not recognized as a separate element until 1746, when the German chemist Andreas Sigismund Marggraf (1709–82) isolated the pure metal by heating calamine and charcoal. Zinc is never found free in nature, but occurs as zinc oxide, ZnO, in the mineral zincite; as zinc silicate, Zn₂SiO₄, in the mineral himimorphite (q.v.); as zinc carbonate, ZnCO₃, in the mineral smithsonite; as a mixed oxide of zinc and iron, Zn(FeO₂)O₂, in the mineral franklinite; and as zinc sulfide, ZnS, in the mineral sphalerite (q.v.). The ores most commonly used as a source of zinc are smithsonite and sphalerite.

The first step in the metallurgy process is to transform the ores to oxides by subjecting them to high temperatures. The oxides are then re-

duced by carbon in an electric furnace, the zinc boiling and distilling from the retort in which the reduction takes place. The zinc obtained by distillation contains small amounts of iron, arsenic, cadmium, and lead, and is known in metallurgy as spelter. In another method of refining zinc, the roasted ores are leached with sulfuric acid. After the impurities have been removed, the solution is electrolyzed. Electrolytic zinc is pure and has superior qualities, such as high resistance to corrosion.

Pure zinc is a bluish-white, crystalline metal, insoluble in hot and cold water, and soluble in alcohol, acids, and alkalis. It is extremely brittle at ordinary temperatures, but becomes malleable between 120° C. (248° F.) and 150° C. (302° F.), and may be rolled into sheets between heated rollers. Zinc is unaffected by dry air; in moist air it is oxidized and becomes coated with a basic-carbonate film that protects it against further corrosion.

Production. In the early 1970's, annual mine production of zinc in the United States was about 766,000 tons, and world production was about 5,083,000 tons annually. Annual consumption of zinc in the U.S. was about 1,800,000 tons. The metal is used principally as a protective coating, or galvanizer, for iron and steel; as an ingredient of various alloys, especially brass; as plates for dry electric cells; and for die castings. Zinc oxide, known as zinc white or Chinese white, is used as a pigment in paints. It is also used as a filler in rubber tires, and is employed in medicine as an antiseptic ointment. Zinc chloride is used as a wood preservative and as a soldering fluid. Zinc sulfide is extremely useful in applications involving electroluminescence, photoconductivity, semiconductivity, and other electronic uses. It is employed as a phosphor for the screens of television tubes and in fluorescent coatings.

ZINC BLENDE. See SPHALERITE.

ZINNIA, genus of annual and perennial plants of the Composite family, Compositae. The genus comprises about sixteen species native mostly to Mexico, but ranging from the southwestern United States as far south as Chile. Zinnias are hardy plants with erect stems bearing opposite leaves and terminal flower heads.

Numerous varieties of zinnia have been developed for garden cultivation, most of them from the Mexican species *Z. elegans*. Tall varieties grow to 30 in. in height, medium varieties average about 20 in., and dwarf varieties grow to about 12 in.

The flower heads grow single or double in a wide variety of colors, and are usually about 3



Ease of cultivation makes the zinnia a popular garden plant throughout most warm regions. Above: *Zinnia haageana*; Below: *Zinnia elegans*.
Burpee Seeds



in. in diameter, though some varieties have much larger heads. Because of their bright, metallic colors, zinnias are popular in gardens for summer and autumn bloom. The species *Z. elegans*, which is the State flower of Indiana, originally had purple or lilac flowers. Other common species include *Z. angustifolia*, with small orange flowers, and *Z. pauciflora*, with red, purple, or yellow petals.

ZINSSER, Hans (1878–1940), American bacteriologist, born in New York City, and educated in medicine at Columbia University. He was professor of bacteriology at Stanford University in 1911, at Columbia University in 1913, and at Harvard University Medical School from 1923 until 1940. A pioneer in the science of immunology (see IMMUNITY), Zinsser did extensive research work on cholera (q.v.) and bacteriological diseases, and became noted for his work in combating typhus fever; see TYPHUS. He isolated the microorganism that causes one form of typhus, and in 1940, with his associates at Harvard University, he devised a method for producing a typhus vaccine in large quantities; see VACCINATION. He wrote *Text Book of Bacteriology* (1911), *Infection and Resistance* and *Resistance to Infectious Disease* (1935), a popular book about typhus, *Rats, Lice and History* (1935), and an autobiography, *As I Remember Him* (1940).

ZINZENDORF, Count Nikolaus Ludwig von (1700–60), German religious leader, born in Dresden, Saxony, and educated at the University of Wittenberg. Zinzendorf was reared by his grandmother, who was a Pietist; see PIETISM.

Herrnhut. In 1722 he granted refuge on his estate in Upper Lusatia (now part of East Germany) to a group of Moravians of the persecuted Bohemian Brethren (q.v.). Their community, called Herrnhut, became a refuge for the Brethren from other lands and for members of other persecuted Protestant sects.

The Brethren functioned for a time within the Lutheran Church, of which Zinzendorf was a member; see LUTHERANISM. In 1727, however, they formed a new denomination, known as the Renewed Church of the Unity of the Brethren. Although opposed to the separation, Zinzendorf continued to lead the congregation. In 1734 he was ordained as a Lutheran minister under an assumed name. Herrnhut missionaries meanwhile had been dispatched to many parts of the world. Zinzendorf's activities aroused the antagonism of influential orthodox Lutherans, and in 1736 he was banished from Saxony.

The Moravians in America. For the next ten years he traveled widely, founding Moravian congregations in the Netherlands, England, Ireland, many sections of Germany, and the Russian provinces of Estonia and Livonia. He visited the American colonies in 1741 and during the next two years helped to establish several Moravian communities in Pennsylvania, including Bethlehem. In addition, he promoted missionary work among the American Indians. Saxony repealed his banishment in 1748, permitting him to spend his final years in Herrnhut.

His Personal Faith. Zinzendorf taught and practiced fervent devotion to Jesus Christ, through Whom alone, he believed, God had revealed Himself to men. He exalted the importance of full emotional participation in worship and insisted that reason has no place in religion. He was also, however, a strong advocate of church discipline. His writings include about two thousand hymns, many sermons, and various polemical treatises.

ZION, city of Illinois, in Lake Co., about 40 miles N. of central Chicago. The city manufactures fig bars and television sets. John Alexander Dowie (q.v.), the Scottish-born religious leader, founded the city in 1901, which had a theocratic administration until 1935. The city presents a Passion play annually. Pop. (1960) 11,941; (1970) 17,268.

ZION or SION, in Jewish antiquity, easternmost hill of the city of Jerusalem (q.v.), lying between the Kidron and Tyropoeon valleys and known now as Temple Hill. It is situated in the Old City. A Jebusite stronghold when it began to figure in Biblical history, Zion was captured about 1000 B.C. by the Hebrew king David (q.v.), who made it the site of his citadel, center of the United Monarchy, and the nucleus of the "City of David", as Jerusalem came to be known (2 Sam. 5:6–7); see JEWS: *The Kingdom*. The site of the original repository of the Ark of the Covenant (q.v.) and, in the view of most present-day scholars, of the Temple (see TEMPLE: *Temple at Jerusalem*), the hill became the center of the political, and cultural life of the ancient Hebrews (q.v.). The name came to signify the "holy hill" of God (Ps. 2:6).

In the course of time the name "Zion" became a designation for all Jerusalem (Isa. 1:27) and for Palestine (q.v.); "daughter of Zion" is a term applied to the Jewish people. After the fall of Judea (70 A.D.), Zion became the symbol of the hope that the Jewish homeland in Palestine eventually would be restored; see ZIONISM.

In the New Testament the term denotes the allegorical heavenly city (Heb. 12:22, Rev. 14:1). **ZIONISM,** movement to unite and settle the Jewish people in Palestine (now largely Israel) with the aim of developing there a Jewish national life and sovereign land. Palestine (q.v.), a historic region on the eastern edge of the Mediterranean Sea, has always been considered, by the Jewish people, as their ancestral homeland. The name of the movement derives from the word "Zion" (q.v.), important in Biblical history as the center of the holy city of Jerusalem (q.v.), often referred to as the "City of David" (see DAVID). In religious theory, the term came to

symbolize the city of God or the holy land. Opposed to the Zionist movement are the assimilationists, who for ideological or practical reasons urge adaptation to the surrounding environment.

Zionism as an organized political movement began toward the end of the 19th century. The roots actually go back, however, to the Jews' first exile in the 6th century B.C. (see BABYLONIAN CAPTIVITY; JEWS), when prophets implanted among them the hope of returning to Palestine. Since then that hope has persisted among Jews living in exile. In all ages, individual Jews have migrated to Palestine to worship, study, and die there; and Jewish communities have existed in all larger towns. Often, through the centuries, self-proclaimed messiahs have tried to organize mass movements for a return to Palestine. The greatest of these movements occurred in the 17th century, when the Jewish mystic Sabbatai Zebi (q.v.) persuaded thousands of Jews, mainly from eastern Europe, to follow him to Palestine. The Turkish government arrested Sabbatai Zebi, and he later embraced Islam.

The Haskalah. A secular Zionism could not arise until Jewish life itself was to some extent secularized. The process of secularization began in the 18th century with the Haskalah (enlightenment), a movement initiated by the German Jewish philosopher Moses Mendelssohn (see under MENDELSSOHN) to familiarize Jews with Western culture. Under the influence of the Haskalah, Jews tended to become more worldly, less religious. They were increasingly inclined to depend on themselves rather than on the Messiah for their redemption. Such attitudes were indispensable to the development of a realistic Zionist movement. The Haskalah was important for another reason also: it loosened the ties of traditional religion and created the need for a Jewish national feeling to replace religion as a unifying force.

Nationalism. While the Haskalah and the yearning for Zion both prepared the ground for Zionism, two major influences from outside Jewish life, nationalism and anti-Semitism (qq.v.), actually brought the Zionist movement to life. In the 19th century nationalism evolved into one of the greatest forces shaping the world. As nationalist movements gained importance, more and more Jews felt it desirable to organize a nationalist movement of their own that would strengthen the Jewish people as other peoples were being strengthened. This feeling was stimulated by the fact that many of the nationalist movements excluded Jews and that some adopted anti-Semitic policies. Anti-

Semitism became increasingly virulent during the 19th century. It reached its climax in the Russian pogroms of the 1880's and the Dreyfus affair (q.v.) in France in the 1890's. Shocked by these events, increasing numbers of Jews urged the organization of movements that could counteract anti-Semitism.

Writings in the 19th Century. This sense of urgency found expression, toward the end of the 19th century, in the writings of certain Jewish intellectuals. The first major publication was *Drishath Zion* ("The Quest of Zion", 1861), by the German rabbi Hersh Kalisher (1795–1874). Although Kalisher was a religious leader, he advocated a secular Zionism. Moses Hess (1812–73), a German socialist, analyzed the Jewish problem in *Rom und Jerusalem* (1862; Eng. trans., "Rome and Jerusalem", 1918) and came to the conclusion that only by creating a democratic socialist state in Palestine could the Jews recover their dignity and creative strength. The Russian Jewish physician Leon Pinsker (1821–91), originally an assimilationist, in his pamphlet *Autoemancipation* (1882; Eng. trans., 1891), took a gloomy view of the Jewish future in Europe and urged the Jews to muster all their strength to achieve freedom and normality as a nation in Palestine. Ahad Ha-am (1856–1927), a Russian Jewish journalist, in a series of essays, pleaded for a cultural Zionism. He thought of Zionism not primarily as a remedy for anti-Semitism but as a basis for spiritual rebirth.

The influence of these writings was soon manifested in practical action. In 1881 the Chovevei Zion ("Lovers of Zion") was founded in Russia, and it spread to all countries that had substantial Jewish populations. In the year of its founding it assisted a group of young Russian Jews, who were eager to start a new life, to establish Rishon-le-Ziyyon, the first modern agricultural settlement in Palestine. Similar settlements soon followed. Unfortunately, the colonists were untrained in agriculture and unprepared to master the pestilential swamps and barren deserts they encountered. They required help in order to survive. The Chovevei Zion groups were too poor and weak to provide such help, and the colonists therefore became dependent on individual Jewish philanthropists, including Sir Moses Haim Montefiore, Baron Moritz Hirsch (qq.v.), and especially Baron Edmond James Rothschild (1845–1934). Though their help was generous, it soon became obvious that individual philanthropists could not sustain whole communities and make them thrive under adverse conditions. A new mass movement was needed to support the settling

of Palestine and the creation of a national life there.

The Austrian writer Theodor Herzl (q.v.) organized such a movement and made it an effective political force. Like most of the Westernized Jewish intellectuals of the 19th century who were shocked into Zionism by the plight of the Jews, Herzl came to it without previous preparation, without full awareness of what had already been done or written about it. It was the Dreyfus affair that impelled Herzl to write *Der Judenstaat* (1896; Eng. trans., *The Jewish State*, 1896). In this work, he argued that anti-Semitism is growing, that assimilation offers no defense against it, and that both together threaten the annihilation of the Jewish people. He regarded the Jewish question as a national question that could be solved only by agreement with other nations, and he therefore urged immediate organized action to secure international backing for the creation of a Jewish state. *Der Judenstaat* aroused bitter controversy among Jews, some of whom preferred total or partial assimilation. When soon after its publication, however, Herzl called for a Zionist Congress, many Jewish leaders were eager to accept his call.

The Basel Program. The first Zionist Congress met at Basel, Switzerland, in August, 1897; there were 204 delegates from all over the world, representative of all currents of Zionist thought. The political Zionists, led by Herzl himself, thought it best to concentrate first on political action, particularly on winning international support for a Jewish state in Palestine. The practical Zionists, who were the most numerous, advocated intensified action to help Jews migrate to Palestine and to settle on the land. Gaining international backing, they argued, could wait. Cultural Zionists emphasized the importance of making Palestine a center for the spiritual and cultural growth of the Jewish people. Still another faction, called the Territorialists and headed by the British writer Israel Zangwill (q.v.), sought to build a national home for Jews in some territory other than Palestine.

Out of this welter of ideas there emerged the Basel program, which has remained the basic platform of the Zionist movement. The Basel program defined Zionism's goal to be the creation "for the Jewish people of a home in Palestine secured by public law", and proposed that the goal be attained through the systematic promotion of Jewish settlement in Palestine.

To provide a basis for organization, the first Congress founded a permanent World Zionist Organization and authorized it to establish branches in every country with a substantial

Jewish population. Zionist congresses assembled annually through 1901; thereafter they met biennially, except for breaks during both World Wars.

After the first Congress, Herzl had several audiences with the Turkish sultan, of whose territories Palestine was then part. Although the sultan appeared sympathetic to the creation of an autonomous Jewish state, negotiations were prolonged and in the end proved fruitless. Herzl also tried to win support from the German emperor and many other leaders, but nothing came of these efforts.

Settlements in Palestine. While the negotiations were going on, the World Zionist Organization proceeded with the practical tasks of settling Jews in Palestine. To help finance such settlement, it established the Jewish Colonial Trust in 1898 and the Jewish National Fund in 1901. These funds enabled many idealistic Jewish workers to migrate from Russia to Palestine, after the failure of the Russian Revolution of 1905 caused them to despair of ending persecution in Russia and persuaded them that only in Palestine could they realize their socialist and Zionist ideals. Arriving in Palestine, they established collective colonies in which all property was held in common, rather than privately, as in all the settlements previously planted. The collectives were the first settlements to become self-sustaining. Their members became the first successful agriculturalists in Palestine since ancient times.

The British Mandate. World War I interrupted Jewish migration to Palestine, but it gave a new decisive impetus to the Zionist cause. In the first place, the British, with Jewish and Arab help, drove the Turks out of Palestine and took charge of the country themselves. In 1917 the British government issued the Balfour Declaration (q.v.), in part out of gratitude for the contributions to the British war effort made by the Zionist leader Chaim Weizmann (q.v.). The Balfour Declaration was incorporated in the Palestine mandate (q.v.), which the League of Nations (q.v.) granted Great Britain in 1922. The mandate, which went into effect in 1923, stipulated that the World Zionist Organization constitute the Jewish Agency, a governing body that was to cooperate with Britain in carrying out the mandate's terms. Although the League of Nations regarded Transjordan (see JORDAN) as part of Palestine, Great Britain unilaterally detached it from Palestine.

The international recognition of Zionist aspirations attracted many new members and caused the old informal associations among



Zionists to crystallize into four types of political parties. On the left were the socialist groups, advocating the building of a socialist commonwealth in Palestine, in which all major enterprises would be publicly or cooperatively owned and in which labor unions would have a decisive voice. In the center were the "general" Zionists, whose political and economic views were not clearly formulated but who stood, in general, for free private enterprise and for democratic government. On the moderate right were a number of religious parties, especially the Mizrahi, which urged strict enforcement by the government of ancient Jewish laws concerning marriage and divorce, observance of the Sabbath, diet, etc. On the extreme right were the Revisionists led by Vladimir Evgenovich Jabotinsky (1880–1940), who opposed the detachment of Transjordan from Palestine and questioned the wisdom of cooperating with the British.

In the early years of the mandate, the Zionist movement contributed substantial sums toward settling Jews in Palestine and developing its economic and cultural life. As this development progressed, the Palestinian Arabs began to react violently to what they regarded as a growing threat to their own interests. In 1929 they attacked Jewish settlements, inflicting many casualties and heavy damage. While the British authorities helped suppress the uprising, they also gave serious consideration to Arab demands that Jewish migration to Palestine be curbed.

Theodor Herzl (center, with black beard) greets a delegate at the first Zionist Congress, held in Basel, Switzerland, in 1897.

Zionist Archives and Library

Britain's increasing sensitivity to Arab pressure, as well as the urgent financial needs of Jewish settlement in Palestine, led to the enlargement of the Jewish Agency in 1929. From that time on, the governing body of the Jewish Agency was composed of the members of the executive committee of the World Zionist Organization and an equal number of non-Zionist Jewish leaders. The latter were willing to assist in settling Jews in Palestine and in developing the country, though they opposed the establishment of a Jewish state. The head of the Jewish Agency was always a Zionist.

In the 1930's the Zionist movement did its utmost to rescue Jews from persecution in Germany and transplant them to Palestine. The increasing influx of Jews led to Arab uprisings between 1936 and 1939, which cost hundreds of Jewish lives and great property losses. As a result the British issued the White Paper of 1939, which limited Jewish immigration to Palestine to 75,000 over the following five years, and stipulated that after ten years a national state was to be established in Palestine in which the Jews were to be a permanent minority.

The outbreak of World War II caused the suspension of Arab-Jewish hostilities and a sharp drop in Jewish immigration. In 1942 a group of Zionist leaders met in New York City and issued the so-called Biltmore program, which repu-

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diated the White Paper and demanded unrestricted immigration. The term "Jewish national home" as the aim of Zionism was replaced by "a Jewish commonwealth integrated in the structure of the new democratic world". The program was later endorsed by the World Zionist Organization. After World War II it became the basis for large-scale illegal immigration into Palestine of Jewish survivors from Germany. There existed also a Jewish plan for a binational (Arab-Jewish) state in Palestine, advocated by the Berit Shalom ("Covenant of Peace") group and the socialist Ha-Shomer ha-Tzair ("The Young Guard") party.

The Creation of Israel. In 1947 the British decided that the mandate had become unworkable, and they referred the whole question to the United Nations (q.v.). That same year, the U.N. voted 33 to 13 to partition Palestine into separate Arab and Jewish states. The Arabs opposed this solution; the Zionists accepted it. On May 14, 1948, the British quit Palestine and the Jews announced the creation of the State of Israel.

The establishment of the State of Israel did not end the Zionist movement, however, but only changed its character. The political leaders of the new state resigned their official positions in the World Zionist Organization, and that organization ceased to function as the Jewish Agency for Palestine. The World Zionist Organization was never officially connected with the State of Israel, although its headquarters are in Jerusalem.

The main purpose of the Zionist movement became to raise funds for the "ingathering of the exiles" and for the economic and cultural development of Israel. It has also exerted political pressure on the U.N. and on various national governments in behalf of Israel.

Zionism constitutes the most significant movement in modern Jewish history. It mitigated the impact of persecution. It provided many Jews with a central purpose that polarized their lives and gave them new hope and spirit. The accomplishments of the movement stirred the imagination and pride even of assimilated Jews in many countries. In a half century, it made possible the fulfillment of the Biblical prophecy of the restoration of Zion toward which Jews had striven for some 1900 years.

In accomplishing its objectives, Zionism also created problems for the Western powers. The support given by the United States and other Western nations to the establishment of the State of Israel has alienated Arabs from the West. Communist powers are using this to gain influence in the Middle East.

N.N.G.

ZIONIST ORGANIZATION OF AMERICA, association founded in 1897 to further the aims of Zionism (q.v.). Objectives of the organization include the extension of moral and financial support to Israel, the furtherance of Hebrew culture, and the promotion of a climate of opinion friendly to Israel. These goals are pursued through diversified educational programs, public affairs programs, youth activities, publications, and projects in Israel. In Israel the organization maintains the ZOA House in Tel-Aviv; Kfar Silver Agricultural High School for Israeli students; and Mollie Goodman Academic High School for American students. The organization publishes *The American Zionist* (monthly); *ZOA in Review* (monthly); *ZINS News Bulletin* (weekly) in English, Yiddish, and Spanish; and *Masada Bulletin*, periodical of the youth organization called Masada. The organization, which has its headquarters in New York City, has a membership of some 100,000. See also HADASSAH, THE WOMEN'S ZIONIST ORGANIZATION OF AMERICA.

ZION NATIONAL PARK, area of natural interest in s.w. Utah. Within the park is vividly colored Zion Canyon, a deep, narrow, vertical-walled chasm cut by the Virgin R. At the s. entrance to the canyon, which is about $\frac{1}{2}$ mi. deep and about 15 mi. long, are two enormous rock formations known as the Watchman (6555 ft.) and the West Temple (7795 ft.); the latter is the highest elevation in the park. Part of the scenic Zion-Mount Carmel Highway traverses the e. half of the park, passing through Zion Tunnel (5607 ft. long). More than 25 mi. of hiking and riding trails are maintained as well as a lodge, cabins, and campgrounds for tourists.

A group of Mormon colonists settled in the canyon about 1861 and called it "Little Zion". The Mormons (q.v.) subsequently named some of the spectacular white-and-crimson-topped cones and buttes in the canyon Angels Landing, the Three Patriarchs, Towers of the Virgin, Altar of Sacrifice, and Great White Throne. Cliff dwellings still in existence in Zion Canyon date back at least 1000 years. The park also contains Kolob Canyon, which is rimmed by vivid red sandstone cliffs from 1500 to 2500 ft. in height. It is administered by the National Park Service (q.v.).

ZIP CODE. See POSTAL SERVICE, UNITED STATES.

ZIRCON, transparent, translucent, or opaque mineral, composed chiefly of zirconium silicate, ZrSiO_4 , and crystallizing in the tetragonal system; see CRYSTAL. It has a hardness of $7\frac{1}{2}$, sp.gr. of 4.2 to 4.86, and shines with an adamantine luster. Zircon may occur as colorless crystals, or in

shades of green, gray, red, blue, yellow, or brown. The clear, transparent yellow, orange, red, and brown varieties are often used as gems (see GEM) and are known as hyacinth or jacinth; translucent or opaque varieties, and most of the colorless types, are known as jargon or jargoon. When subjected to high temperatures, zircons either change color or lose their color, and assume a greater brilliance. Colorless zircons are known as Matura diamonds, or white zircons. A blue variety, produced by heat treatment and known as blue zircon, is also commonly used as a gem stone. Zircon occurs as an accessory mineral in all types of igneous rocks (q.v.), and is abundant in silicic rocks such as granite, granodiorite, syenite, and monzonite. It is also found, often together with gold, as rounded grains in streams and along sandy beaches. Deposits of gem zircons are found in Ceylon, Madagascar, Norway, and in New South Wales, Australia; no zircons of gem quality are found in the United States. The chief sources of zircon as an ore of zirconium (q.v.) are Brazil, Australia, and Florida and Georgia.

ZIRCONIUM, metallic element with at.no. 40, at.wt. 91.22, b.p. 4415° C. (7979° F.), m.p. about 1852° C. (3365.6° F.), sp.gr. 6.5 at 20° C., and symbol Zr. The element was discovered in 1789 by the German chemist Martin Heinrich Klaproth (1743–1817) and isolated in 1874 by the Swedish chemist Baron Jöns Jacob Berzelius (q.v.). It ranks nineteenth in abundance among the elements in the crust of the earth. Zirconium is never found free in nature, but occurs chiefly as a silicate in the mineral zircon (q.v.), and as an oxide in the mineral baddeleyite, which is found in commercial quantities in Brazil. Zirconium ores also contain the element hafnium (q.v.), a metal with properties similar to those of zirconium.

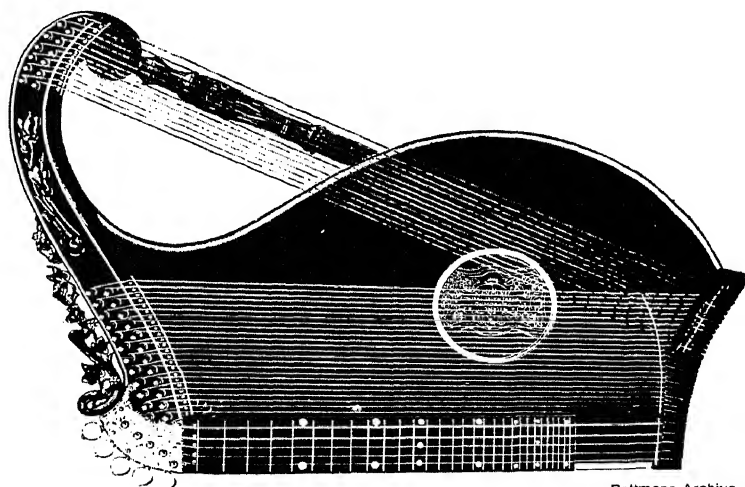
In its pure state zirconium exists in two forms, crystalline and amorphous. Crystalline zirconium is a soft, white, ductile metal; the amorphous form is a bluish-black powder. Both forms are insoluble in water, slightly soluble in alcohol, and completely soluble in hydrofluoric acid. The metal burns in air at 500° C. (932° F.).

Zirconium is used in the manufacture of steel, porcelains, certain nonferrous alloys, and refractories. It is also used in vacuum tubes to remove traces of gases because it combines readily with oxygen, hydrogen, and nitrogen at high temperatures. Zirconium is used in heat exchangers, pump housings, valves, and other equipment subject to corrosion by acids. Special alloys of the metal called zircaloy-2 and zircaloy-4, which contain 1½ percent tin, are used in nuclear reactors as a cladding material for uranium fuel elements and as a structural material; see NUCLEAR POWER. Zirconium is especially suitable in water-moderated reactors because of its low neutron absorption cross-section, excellent corrosion resistance at moderately elevated temperatures, strength, ductility, and ease of fabrication.

A pilot plant operated by the United States Bureau of Mines was the original source of the metal used by the Atomic Energy Commission. Its production in 1948 was 3000 lb. of sponge zirconium. Since 1955 private industry has been producing zirconium. Production in 1968 was estimated at 39,000 short tons with demand that year about 72,000 short tons. The difference was made up by imports from Australia, the largest producer of zirconium in the world, accounting for more than 70 percent of world production. The other major producer of the metal is the U.S.S.R.

ZITHER, stringed musical instrument descended from the psaltery and the dulcimer

A 42-string zither



Beltmann Archive

ZOAR, SEPARATIST SOCIETY OF

(qq.v.). It consists of from thirty to forty-five strings stretched over a shallow wooden sound box, with a fingerboard under five of the strings. The melody is played on these five strings with the fingers; the remaining strings are used for the accompaniment being plucked with a plectrum fixed to the thumb. The zither's tone is plaintive and resonant, with a pleasant "sing-ing" quality.

A large variety of zithers is found. In the most common type, the sound box is oblong and about 2½ ft. long. The concert zither has a longer box and a more powerful tone, and the elegy zither has a still longer box and a deeper tone. Another, less common type of instrument is the so-called *Streichzither*, which is played with a bow.

The zither is a member of one of the oldest and largest families of musical instruments. This family goes back to the Greek cithara and lyre and to ancient Chinese instruments; it includes dulcimers, psalteries, lutes, and guitars.

The zither became the favorite instrument of the peasants of the German, Austrian, and Swiss Alps in the 19th century, and it has maintained its popularity to the present day. Its most famous performer was the Austrian musician Johann Petzmayer (1803–84), who became known as the "Paganini of the zither". After the release of the British film *The Third Man* (1950), for which the Austrian zitherist Anton Karas played background music, the zither enjoyed a vogue lasting several years.

ZOAR, SEPARATIST SOCIETY OF, communistic colony of the 19th century established in Tuscarawas Co., Ohio, by German religious dissenters. Zoar was founded in 1817 by 225 refugees from religious persecution in Germany. Their leader was Joseph Michael Bäumlér (later Bimeler; about 1778–1853), a man of unusual ability both as religious teacher and businessman. British and American Quakers (see **FRIENDS, SOCIETY OF**) helped the migrants to buy a tract of fertile land, on which they built homes, farms, mills, and workshops. In 1819 they became a communistic society, sharing all their goods equally, and they later incorporated the community as The Society of Separatists of Zoar in 1832. At its peak, the society had about 500 members and property worth about \$1,500,000. Its wealth was derived from the sale of a wide variety of high-quality manufactures.

Despite its prosperity, the colony gradually declined, especially after the death of Bimeler in 1853. One reason was that it had been extraordinarily dependent upon his strength and intelligence, and nobody was found to replace him.

Another was that the society failed to adopt new manufacturing methods, and consequently markets were lost to more progressive competitors. The third and final reason for the colony's decline was that the strictness and narrowness of the society's way of life did not appeal to the young people, who gradually drifted away, leaving only the old, the unmotivated, and the incompetent. In 1898 the society dissolved and distributed its assets among the remaining members. In 1970 the population of the village of Zoar was 228.

See **COMMUNISM: Early American Experiments in Communism**.

ZODIAC, imaginary belt in the celestial sphere, extending about 8° on either side of the ecliptic (q.v.), the apparent path of the sun among the stars. The width of the zodiac was determined originally so as to include the orbits of the sun and moon and of the five planets (Mercury, Venus, Mars, Jupiter, and Saturn) that were known to the people of ancient times. The zodiac is divided into twelve thirty-degree sections which are called the signs of the Zodiac. Starting with the vernal equinox, and then proceeding eastward along the ecliptic, each of the divisions is named for the constellation situated within its limits in the 2nd century B.C. The names of the zodiacal signs are Aries, the Ram; Taurus, the Bull; Gemini, the Twins; Cancer, the Crab; Leo, the Lion; Virgo, the Virgin; Libra, the Balance; Scorpio, the Scorpion; Sagittarius, the Archer; Capricornus, the Goat; Aquarius, the Water Bearer; and Pisces, the Fishes. Owing to the precession of the equinoxes about the ecliptic, a 26,000-year cycle, the first point of Aries retrogrades about 1° in 70 years, so that the sign Aries today lies in the constellation Pisces. In about 24,000 years, when the retrogression will have completed the entire circuit of 360°, the zodiacal signs and constellations will again coincide. See **ASTRONOMY**.

The zodiacal signs are believed by many authorities to have originated in Mesopotamia as early as 2000 B.C. According to that theory, the Greeks adopted the symbols from the Babylonians, and thereafter the zodiac was passed on to the other ancient civilizations. The Egyptians assigned other names and symbols to the zodiacal divisions. The Chinese also adopted the twelve-fold division, but called the signs, respectively, rat, ox, tiger, hare, dragon, serpent, horse, sheep, monkey, hen, dog, and pig. The Aztec Indians devised a similar system, apparently developed independently. See also **ASTROLOGY** and the separate articles on the signs of the zodiac.

ZOG I. See **ALBANIA: History**.

Armillary sphere with zodiac. The rings show positions of important circles of the celestial sphere. Woodcut from *Tractatus de Sphaera Mundi* by English mathematician Johannes de Sacrobosco (d. 1256)

Granger Collection



ZOLA, Émile (1840–1902), French author, born in Paris. His first job was as a clerk in a publishing house. After 1865 he was able to support himself by writing verse, short stories, and literary and art criticism.

His first important novel, *Thérèse Raquin* (1867), is a vivid psychological study of murder and passion. Later, inspired by scientific experiments in heredity and environment, Zola determined to produce a new type of novel that would probe deeply into every area of human existence and document every social ill, no matter how politically sensitive. He called his new school of fiction naturalism (q.v.), and he wrote

a series of twenty novels between 1871 and 1893, under the generic title *Les Rougon-Macquart* (Eng. trans., 20 vol., 1885–1907), to illustrate his theories in terms of the saga of one family. Through painstaking research, he produced an arresting and complete picture of French life, particularly of Paris, in the late 19th century. He was, however, criticized for obscenity and for exaggerating the frequent criminality and pathological behavior of the lower classes.

Several of the books, dealing with five generations of the Rougon-Macquart family, became famous. Among the novels in the series are *L'Assommoir* ("The Dram Shop", 1877), on alcohol-

ism; *Nana* (1880), on prostitution and the demi-monde; *Pot-Bouille* ("The Stew", 1882), on middle-class pretensions; *Germinal* (1885), on coal mining; *La Bête Humaine* ("The Human Beast", 1890), on railroading; and *La Débâcle* ("The Downfall", 1892), on the collapse of the Second Empire. These books, which Zola characterized as social documents, greatly influenced the later naturalistic development of the novel. His own later novels, written after 1893,



Émile Zola

were less objective, more evangelistic, and consequently less effective as novels. They include the series called *Les Trois Villes* (3 vol., 1894-98; Eng. trans., *The Three Cities*, 3 vol., 1894-98), comprising *Lourdes* (1894), *Rome* (1896), and *Paris* (1898). Zola also produced a number of volumes of literary criticism in which he attacked his literary opponents, the romanticists; see ROMANTICISM: *Literature: French Literature*. The best of his critical writing is contained in *Le Roman Expérimental* ("The Experimental Novel", 1880) and *Les Romanciers Naturalistes* ("The Naturalistic Fiction Writers", 1881).

In January, 1898, Zola wrote an open letter, published in the Paris newspaper *L'Aurore*

("Dawn"). This was the famous "J'accuse" ("I accuse") letter, in which Zola attacked French officials for their persecution of the French artillery officer Alfred Dreyfus, who had been found guilty of treason; see DREYFUS AFFAIR.

Most of the novels of Zola are available in English translation, and many of them have been adapted into plays and motion pictures. **ZOLLVEREIN.** See CUSTOMS UNION.

ZOMBA, town of Malawi, capital of the Southern Province, in the Shire Highlands, about 40 miles N.E. of Blantyre. Cement and processed food are manufactured in the town, and the surrounding highlands produce tobacco and cotton and contain limestone deposits. The University of Malawi (founded 1964) is in Zomba. To the N. is the Zomba Plateau, a popular summer resort. Zomba, founded by European planters in the mid-1880's, became the capital of the British Nyasaland protectorate in 1891. The town was the capital of independent Malawi from 1964 to 1975, when it was succeeded by Lilongwe. Pop. (1971 est.) 20,000.

ZONE, in geography, any of the five divisions of the surface of the earth characterized by their latitude or temperature differences; see EARTH; GEOGRAPHY; LATITUDE AND LONGITUDE; TEMPERATURE. The zones are divided by the Tropic of Cancer, the Tropic of Capricorn (see TROPICS), the Arctic Circle, and the Antarctic Circle. See also ANTARCTICA; ARCTIC, THE.

From north to south, the zones are designated North Frigid Zone, North Temperate Zone, Torrid Zone, South Temperate Zone, and South Frigid Zone. The boundaries of the zones are circles of latitude determined by the obliquity of the equator to the ecliptic (q.v.), the Tropics being 23°27' north and south of the equator, and the Arctic and Antarctic circles being the same distance from the poles, or 66°33' north and south of the equator, respectively. At the summer solstice (q.v.), the sun, which is then in the sign of Cancer, appears directly overhead at the Tropic of Cancer; the same condition holds at the Tropic of Capricorn at the winter solstice, when the sun is in the sign of Capricorn; see ZODIAC. In the Torrid Zone, the sun is almost directly overhead during the entire year; the days and nights are practically equal in length, and the rays of the sun are vertical, causing perpetual summer. In the Temperate zones, because of the changing obliquity of the sun during the year, the climate varies with a succession of seasons, and the relative lengths of day and night change throughout the year. As the distance from the equator increases, the difference in the length of day and night is more marked; at the

Arctic and Antarctic circles the sun does not set on the day of the summer solstice, and does not rise at the winter solstice. At the poles, the sun rises and sets once a year, day and night each being six months long.

ZONING. See CITY PLANNING.

ZOOLOGICAL GARDENS or ZOOLOGICAL PARKS, institutions, known popularly as zoos, which display live animals for public entertainment, education, and scientific study; see ZOOLOGY. These institutions usually build environments that simulate the native habitats of the animals and differ from menageries, in which the animals are exhibited, usually in small cages, for profit-making purposes. Zoos are also different from the so-called zoological stations, which are usually established in the habitat of the animals studied for scientific purposes.

Collections of captive animals have been kept since ancient times by kings and emperors of countries as diverse as Egypt and China, but the concept of a zoological park, in which animals may be given the greatest practicable freedom of movement, is a recent development. Beginning in the 19th century, the steel bars formerly used to restrain dangerous animals and protect the public were frequently replaced by ditches, or moats, too wide and deep for the animals to cross. Hardy animals are permitted to roam over large, open-air ranges. In cool seasons and climates, tropical animals are housed in heated buildings. In some zoological gardens animals of different species are exhibited in a common enclosure; such exhibits occasionally include nearly all of the animals of a region. Many modern zoos incorporate aquariums and aviaries for the purpose of accommodating and displaying exotic fishes and birds; see AQUARIUM. Zoological gardens today frequently have an area called a children's zoo for very young visitors to play with and ride tame animals, such as elephants and camels.

The first modern zoological garden, or zoo, was established in 1793 in connection with the Jardin des Plantes, in Paris. The famous Zoological Garden in Regent's Park, London, was established in 1828 by the Zoological Society of London. In 1931 this society opened Whipsnade Park, in Bedfordshire, the 567-acre area being one of the finest park zoos in the world. The oldest zoo in the United States was opened in New York's Central Park in 1864. The Philadelphia zoo opened in 1874, and in 1889 the National Zoological Park was established in Rock Creek Park, Washington, D.C., by the Federal government. The New York Zoological Park, situated in Bronx Park, New York City, and

known popularly as the Bronx Zoo, opened in 1899. Founded by the New York Zoological Society, with the cooperation of the city of New York, the Bronx Zoo has one of the largest and most complete collections of animals in the world.

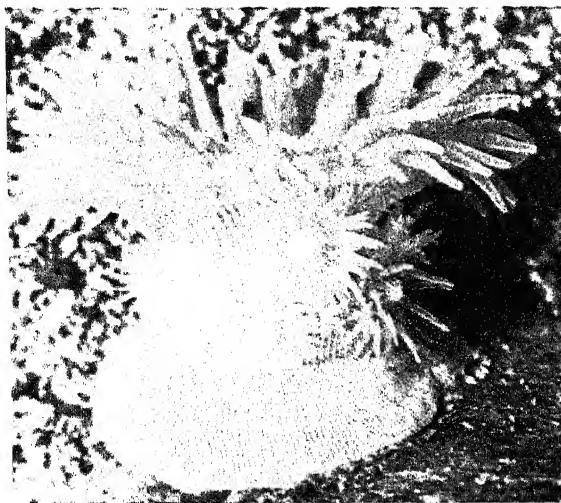
Many large cities in the U.S. now maintain a zoological park. In addition to the Bronx Zoo, there are three others in New York City: in Central Park, Manhattan; in Prospect Park, Brooklyn; and on Staten Island. Chicago maintains a zoo in the city at Lincoln Park and another in Brookfield, a nearby suburb. Other important collections are those in the Forest Park Zoological Gardens, Saint Louis, Mo.; the San Diego Zoo, San Diego, Calif.; and the Detroit Zoological Park, Royal Oak, Mich.

Notable zoological gardens abroad include those at Bombay and Calcutta, India; Karachi, Pakistan; Cairo, Arab Republic of Egypt; Tokyo, Japan; Zürich, Switzerland; Berlin and Munich, West Germany; Vienna, Austria; Budapest, Hungary; and Rome, Italy.

ZOOLOGY, the branch of biology (q.v.) devoted to the study of the animal kingdom (Animalia), which comprises multicellular organisms that obtain energy by ingesting food and have cells organized into tissues.

History. The study of zoology can be viewed as a series of efforts to analyze and classify animals. Attempts at classification as early as 400 B.C. are known from documents in the Hippocratic Collection. Aristotle (q.v.), however, was the first to devise a system of classifying animals that recognized a basic unity of plan among diverse organisms; he arranged groups of animals according to mode of reproduction and habitat. Observing the development of such animals as the dogfish, chick, and octopus, he noted that general structures appear before specialized ones, and he also distinguished between asexual and sexual reproduction. His *Historia Animalium* contains accurate descriptions of extant animals of Greece and Asia Minor. He was also interested in form and structure and concluded that different animals can have similar embryological origins and that different structures can have similar functions.

In Roman times Pliny the Elder (see under PLINY) compiled a thirty-seven-volume treatise called *Historia Naturalis*. Although widely read during the Middle Ages, his four volumes on zoology are little more than a collection of folklore, myth, and superstition. One of the more influential figures in the history of physiology, the Greek physician Galen (q.v.) was however a source of many misconceptions—especially



A sea anemone (*Epiactis prolifera*), of the phylum *Coelelenterata*, brooding young in a groove around its body.
R. N. Mariscal-Bruce Coleman, Inc.

with regard to the movement of blood. His concepts remained virtually unchanged for hundreds of years until, in the 17th century, the English physician William Harvey (q.v.) established the true mechanism of blood circulation. Until the Middle Ages, therefore, zoology was a conglomeration of folklore, superstition, misconception, and descriptions of animals.

It was during the 12th century that zoology began to emerge as a science. Perhaps the most important naturalist of the era was the German scholar Saint Albertus Magnus (q.v.), who denied many of the superstitions associated with biology and reintroduced the work of Aristotle. The Renaissance was dominated by Leonardo da Vinci (q.v.), whose anatomical studies were far in advance of the age. His dissections and comparisons of the structure of man and other animals led him to important conclusions. He noted, for example, that the arrangement of joints and bones in the leg are similar in both the horse and man, thus grasping the concept of homology. The value of his work in anatomy was not immediately recognized. Instead, the Belgian physician Andreas Vesalius (q.v.) is considered the father of anatomy; it was he who established the principles of comparative anatomy.

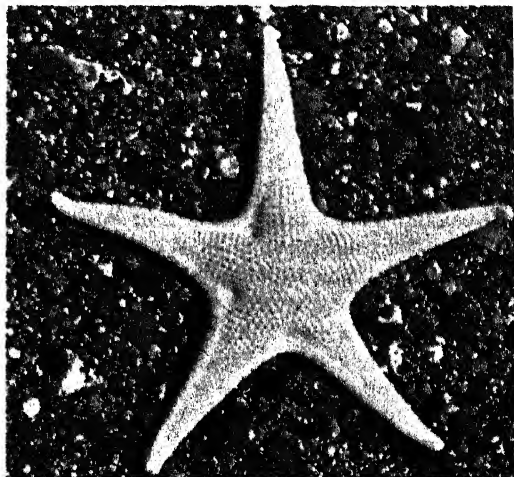
Classification dominated zoology throughout most of the 17th and 18th centuries. The Swedish botanist Carolus Linnaeus (q.v.) developed a system of nomenclature that is still used today—the binomial system of genus and species (see CLASSIFICATION)—and established taxonomy as a discipline. He followed the work of the English naturalist John Ray (1627?-1705) in relying upon

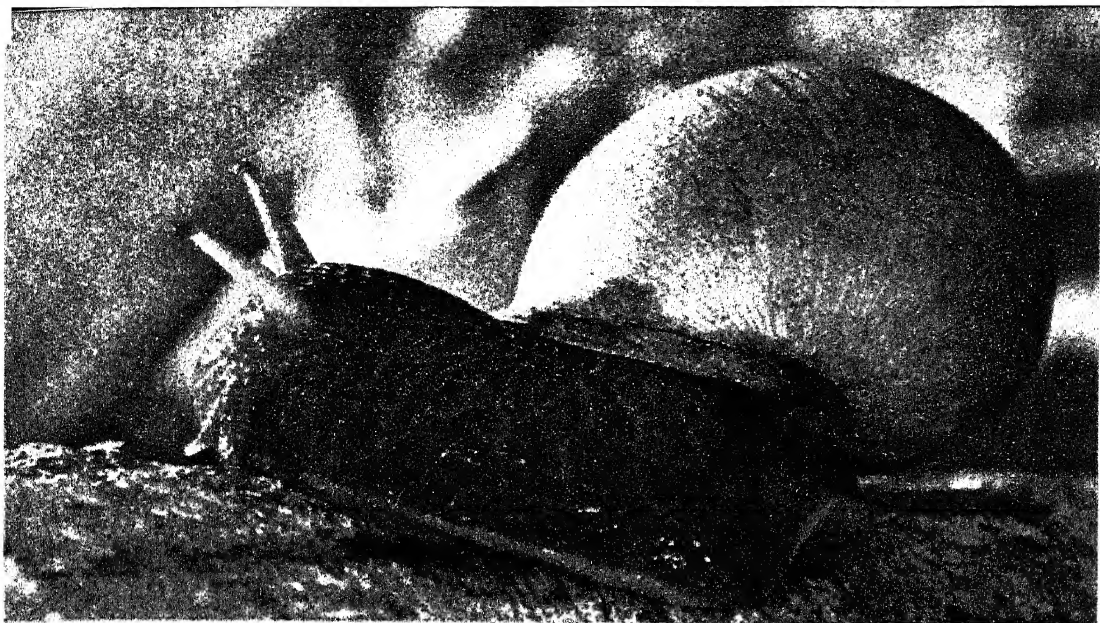
the form of teeth and toes to differentiate mammals and upon beak shape to classify birds. Another leading systematist of this era was the French biologist Comte Georges Louis Leclerc de Buffon (q.v.). The study of comparative anatomy was extended by such men as Georges Cuvier (q.v.), who devised a systematic organization of animals based on specimens sent to him from all over the world.

Although the word “cell” was introduced in the 17th century by the English scientist Robert Hooke (q.v.), it was not until 1839 that two Germans, Matthias Jakob Schleiden and Theodor Schwann (qq.v.), proved that the cell is the common structural unit of living things. The cell concept provided impetus for progress in embryology, founded by the Russian scientist Karl von Baer, and for the development by a Frenchman, Claude Bernard (qq.v.), of the study of animal physiology, including the concept of homeostasis (the stability of the body’s internal environment).

The organization of scientific expeditions in the 18th and 19th centuries gave trained observers the opportunity to study plant and animal life throughout the world. The most famous expedition was the voyage of the *Beagle* in the early 1830’s. During this voyage, Charles Darwin (see under DARWIN) observed the plant and animal life of South America and Australia and developed a theory of evolution (q.v.). His publication in 1859 of *The Origin of Species* led to abandonment of the view that all species are specially created. Darwin’s theory accounted for the formation of new species by a process he called natural selection. Noting differences within species, some of which can be inherited

This five-rayed starfish (*Mediaster aequalis*) is a member of the phylum *Echinodermata*, which also includes sea urchins, sea cucumbers, sand dollars, and sea lilies.
R. N. Mariscal-Bruce Coleman, Inc.





This giant land snail (Achatina fulica) belongs to the phylum Mollusca; other mollusks include the clam, the oyster, and the octopus.

O.S.F.-Bruce Coleman, Inc.

by offspring, he concluded that individuals varying in ways that make them better adapted to their environments will have a higher survival rate and thus produce more offspring. This natural selection of the most favorable variations he saw as the means of evolutionary change. Although Darwin recognized the importance of heredity (q.v.) in understanding the evolutionary process, he was unaware of the work of the Austrian monk Gregor Mendel (q.v.), who first formulated the concept of particulate hereditary factors—later called genes. Mendel's work was not rediscovered until 1900.

In the 20th century zoology has become more diversified and less confined to such traditional elements as classification and anatomy. Broadening its range to include such studies as genetics, ecology, ethology, and biochemistry, zoology has become an interdisciplinary field applying a great variety of techniques to obtain knowledge of the animal kingdom.

Subdisciplines. The study of zoology has two main focuses: on particular taxonomic groups and on the structures and processes common to most of them.

Taxonomically oriented studies concentrate on the different divisions of animal life. Invertebrate zoology deals with multicellular animals without backbones; its subdivisions include entomology (the study of insects) and malacology (the study of mollusks). Vertebrate zoology, the study of animals with backbones, is divided into ichthyology (fish), herpetology (amphibians and reptiles), ornithology (birds), and mammalogy (mammals). Paleontology, the study of fossils, is subdivided by taxonomic groups. In each of

these fields, researchers investigate the classification, distribution, life cycle, and evolutionary history of the particular animal or group of animals under study. Most zoologists are also specialists in one or more of the process-oriented disciplines described below.

Morphology, the study of structure, includes gross morphology, which examines entire structures or systems, such as muscles or bones; histology, which examines body tissues; and cytology, which focuses on cells and their components. Many great advances made in cytology in recent years are attributable to the electron microscope and the scanning electron microscope. Special staining techniques and radioactive tracers have been used to differentiate structural detail at the molecular level—the enzymatic components of metabolism, for example. Other important morphological developments have been in neurology—the study of the nervous system, including the brain. The perfection of methods for mapping neural connections between parts of the brain and of techniques for stimulating and recording impulses from specific brain sites may eventually lead to clarification of the mechanism of thought. Recent developments in functional morphology have been concentrated on the skeletomuscular system—on such aspects as locomotion and mastication—and have been applied in physical therapy and orthopedic surgery.

Physiology, the study of function, is closely associated with morphology. An important subdivision is cellular physiology, which is closely



The victor, a green lynx spider (class Arachnida), and the vanquished, a wasp (class Insecta), both belong to the huge phylum Arthropoda.

J. H. Robinson—Photo Researchers, Inc.

related to molecular biology and explores the functions of such cellular components as mitochondria and lysosomes. Another active field, physiological ecology, studies the physical responses of animals to their environment. Recent investigations have dealt with thermal regulation, the role of the environment in regulating energy flow patterns of animals. Much of this work has been carried out on desert and arctic animals that must survive extremes of temperature.

Animal behavioral studies have developed along two lines. The first of these, animal psychology, is primarily concerned with physiological psychology and has traditionally concentrated on laboratory techniques such as conditioning. The second, ethology, had its origins in observations of animals under natural conditions. Ethology concentrates on behavioral interactions between individuals during courtship, flocking, and other social contacts. Both subdisciplines have recently incorporated many experimental techniques from neurology. Perhaps the most important recent behavioral developments include the new field of sociobiology, which is concerned with the behavior,

ecology, and evolution of social animals such as bees, ants, schooling fish, flocking birds, and man. Sociobiology is still in its infancy and is quite controversial, chiefly because it has raised anew the old dispute as to whether behavior is or is not genetically determined. Another interdisciplinary field associated with behavior is concerned with the study of daily (circadian), annual (circannual), and migratory cycles. Such research has revealed, for example, that some animals can maintain a 24-hour cycle for many months under constant light conditions.

Endocrinology is the study of hormones and their action on target organs. Neuroendocrinology is especially important in vertebrates and in such higher invertebrates as arthropods. In vertebrates, the pituitary gland of the brain secretes neurohormones that control annual cycles. The pineal body, another extension of the brain, appears to be responsible for the 24-hour cycle. Embryology, the study of the ontogenetic development of animals, has investigated the way in which developing parts interact—for example, the interactions between the eyestalk and the epidermis during development of the lens of the eye. The emerging field of molecular development applies the techniques of molecular biology, including molecular genetics, to the finest and most obscure embryological details.

Genetics is the study of inheritance and of the laws that govern transmission of traits from parents to offspring. Population genetics deals with the mechanism of gene transfer in interbreeding populations. Molecular genetics has made great progress since it established the structure and means of replication of the DNA molecule and unlocked the genetic code that regulates protein synthesis. Its discoveries have facilitated the solution of many problems of classical genetics, such as the nature of mutation. See HEREDITY.

The study of the interactions between animals and their environment is known as ecology. Primary attention is given to the complex pattern of interactions among the many species comprising a community. Ecology has been central to the development of conservation and environmental control during the past twenty years. It has revealed the deleterious effects of pesticides and industrial pollutants and has provided important insights into wiser management of agriculture, forestry, and fisheries.

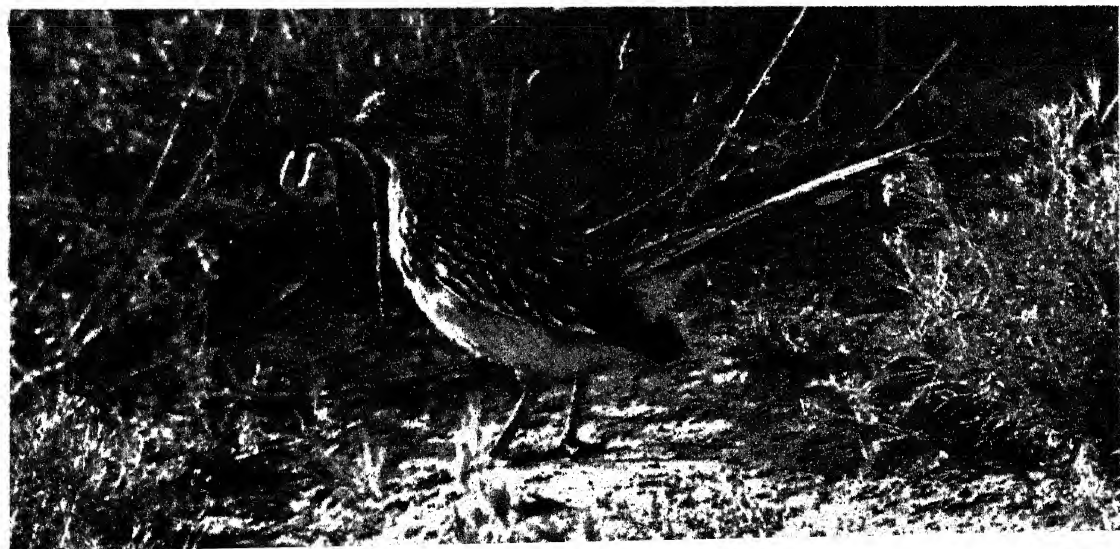
Evolutionary zoology, which draws on all of the above fields, is concerned with the mechanisms of evolutionary change—speciation and adaptation—and with the evolutionary history of animal groups. Particularly relevant to evolutionary studies are systematics, phylogenetics, paleontology, and zoogeography. Systematics deals with the delineation and description of animal species and with their arrangement into a classification. Phylogenetics is the study of the developmental history of groups of animals. Zoogeography, the study of the distribution of animals over the earth, is closely related to ecology and systematics.

Animal Origins. The evolution of animals from primitive forms probably involved several

basic steps. Multicellular animals evolved from unicellular forms, perhaps from colonies made up of both somatic (body) cells and reproductive cells. Then an inpocketing formed that would later become the digestive cavity. At this stage animals had a gel-like mesoglea sandwiched between two layers of somatic cells—an outer epidermis and an inner gastrodermis—and had attained a tissue level of organization as well as radial symmetry. Next, the evolution of bilateral symmetry and cephalization (head formation) resulted in definite dorsoventral (up-down), anteroposterior (front-back), and right-left polarities. A middle layer, the mesoderm, eventually appeared between the (outer) ectoderm and the (inner) endoderm. Muscles derived from the mesoderm replaced cilia as the main force-generating system. By this time animals with the three cell layers were at the organ level of organization. Specialized circulatory, respiratory, and excretory systems evolved as the organisms increased in size. Another major step was the formation of the anus and a continuous digestive system. Primitive animals lacked a body cavity. Such a cavity, within the mesoderm, evolved independently at least three times in the higher animals. One cavity, the pseudocoelom, is not completely lined by mesodermal cells; it is found in spiny-headed worms and Aschelminthes (see *Classification*, below). The true coelom, a body cavity completely lined by mesoderm, apparently evolved at least twice in the higher animals, or coelomates. The two groups, known as the deuterostomes and protostomes, are distinguished by their mechanisms of embryological develop-

The phylum Chordata, which contains all the vertebrate animals, includes such varied forms as this roadrunner (class Aves) and the snake (class Reptilia) it has captured.

Anthony Mercieca—Photo Researchers, Inc.



ZOOLOGY

ment. The mouth of deuterostomes—including the echinoderms, arrowworms, brachiopods, and chordates—develops from an opening other than the blastopore, and the coelom develops from buds off the embryonic gut. The mouth of protostomes—including arthropods and annelid worms—develops from the blastopore, and the coelom develops from a split in the mesoderm. The mollusks, which are usually placed with the protostomes, may have had an independent origin from an acoelomate ancestor.

Classification. The classification of animals is based in part on their evolutionary history and thus represents divergence among groups, as well as the phylogeny of specific groups. At any level in the hierarchy of classification, a taxonomic group (taxon) should be monophyletic; that is, all members should be descended from closely related ancestors. The members of a monophyletic taxon thus share a number of homologous traits, i.e., those that stem phylogenetically from the same trait in the common ancestor. The hierarchy of categories by which animals are classified includes the following: species, genus, family, order, class, phylum, and kingdom. Sometimes, intermediate categories, such as suborder and tribe, are also required.

An animal is designated by a two-word name consisting of a generic name and a trivial name (an adjective, usually descriptive or geographic). Each binomial name is unique and is fixed by a type specimen (name-bearer) selected when the species is described. The rules of zoological no-

menclature, as overseen by the International Committee on Zoological Nomenclature, govern the use of scientific names.

In the five-kingdom system of classification used in this encyclopedia, the kingdom Animalia is limited to multicellular organisms that obtain energy by ingesting food and that have cells organized into tissues (see ANIMAL). The major animal phyla may be grouped according to the number of cell layers they possess.

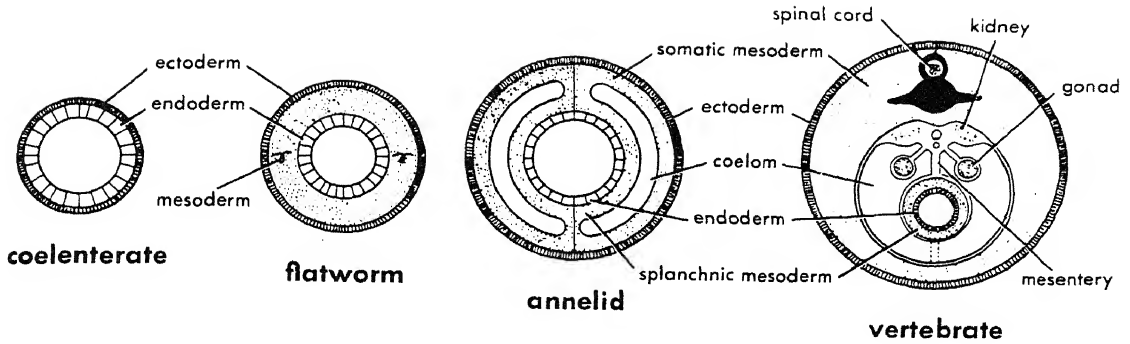
Phyla having two cell layers—epidermis and gastrodermis—include the Porifera, Mesozoa, Coelenterata, and Ctenophora. The Porifera, or sponges (see SPONGE), number more than 4000 mostly marine species of saclike organisms having many pores and flagellated cells, called collar cells, for feeding. The 50 marine species of the phylum Mesozoa are minute wormlike parasites with cilia; they lack organs. The 5000 species of Coelenterata (q.v.), which includes jellyfish, sea anemones, corals, and hydras, have radial symmetry. Most species are marine. The Ctenophora (q.v.), or comb jellies, are small spherical marine animals; about 80 species are known.

Animals with three cell layers—ectoderm, mesoderm, and endoderm—include the Platyhelminthes, pseudocoelomates, and coelomates. The Platyhelminthes, or flatworms, comprise about 15,000 species. Some are free-living (planarians); others are parasites (flukes and tapeworms). They are found in marine and fresh water and in soil. Pseudocoelomates include the phyla Acanthocephala and Aschelminthes. Acanthocephala, or spiny-headed worms, which lack a digestive system, number about 300 spe-

Also exemplifying major classes of Chordata are this young bear (Mammalia) and its catch, a salmon (Osteichthyes).

Tom Bledsoe-Photo Researchers, Inc.





Diagrammatic cross sections of different body types.

From *Animal Biology*, 5th Edition, by Guyer and Lane, p. 72. Copyright © 1964 by the Estate of Michael F. Guyer and by Charles E. Lane. By permission of Harper & Row, Publishers, Inc.

cies of parasitic worms in marine waters and soil. The numerous species of Aschelminthes include the rotifers, hairworms, and nematodes.

Coelomate groups comprise the majority of animal species. The phyla Entoprocta, Bryozoa, (q.v.; moss animals), Brachiopoda (q.v.; lampshells), and Phoronida are sometimes grouped as the superphylum Tentaculata because of their similarities. The Annelida (q.v.) comprise about 9000 species of segmented worms found in marine water and soil. The Mollusca include more than 100,000 living and extinct species, such as the snail, bivalve, and squid (qq.v.). The largest phylum in number of species (more than 1,000,000) and the most diverse in form is the Arthropoda (q.v.), comprising joint-legged animals that have a hard outer skeleton. Included are the insects, crustaceans, and spiders. The marine Echinodermata (q.v.) number about 6000 extant and 13,000 extinct species of starfish, sea urchins, sand dollars, brittle stars, sea cucumbers, and sea lilies. The 50 species of Chaetognatha, or arrowworms, are also marine. The Chordata (q.v.), with some 45,000 species, include the lancelets, tunicates (see UROCHORDA), and vertebrates (q.v.), all characterized by a dorsal, tubular nerve cord and an internal skeleton. W.J.B.

ZORACH, William (1887-1966), American sculptor and painter, born in Jurbarkas, Lithuania, and educated mainly in New York and Paris. In 1891 his family emigrated to the United States, settling near Cleveland, Ohio. Subsequently he became a lithographer there and attended night classes in painting. He adopted cubism (q.v.) while studying in Paris from 1910 to 1912. In 1917 he began producing sculpture, and in 1922 he abandoned oil painting completely. He applied his cubist style to wood, stone, and metal, giving his work notable individuality. Eventually, he moved away from ab-

straction toward realistic representations of human and animal forms. He was best known, however, for his simplified human figures, among them his "Mother and Child" (1930, Metropolitan Museum of Art, New York City). His autobiography, *Art is My Life*, was published posthumously, in 1967.

ZORN, Anders Leonhard (1860-1920), Swedish painter, etcher, and sculptor, born in Mora. He became a skilled wood-carver during his boyhood, and his deft pencil portraits won him admission at the age of fifteen to the Royal Academy of Arts in Stockholm. Seven years later he opened a fashionable studio in London where he subsequently studied the art of etching (q.v.).

Until 1885 Zorn earned his living mostly by painting portraits of the wealthy; he also traveled widely. In 1887 he began to paint in oil; his first major oil painting, "Fisherman from St. Ives" (1888), was acquired by the Luxembourg Museum; it is currently in the National Museum of Modern Art in Paris. From 1888 to 1893 Zorn lived for the most part in Paris. Later, he traveled about again and executed many remarkable portrait etchings of famous artistic and literary figures such as the French writers Anatole France and Paul Verlaine, the French sculptor Auguste Rodin, and the Swedish dramatist August Strindberg (qq.v.). Zorn visited the United States for the first time in 1893; on five subsequent visits he made portraits of many prominent Americans, including Presidents Grover Cleveland, William Howard Taft, and Theodore Roosevelt (qq.v.). After 1896 he resided chiefly in Mora and painted nudes and folk scenes of the Swedish countryside.

Zorn was especially adept at depicting the interplay of light and water upon nude females bathing in lakes and at the seashore. His best-

ZOROASTER

known sculptures include a bronze statuette, called "Nymph and Faun" (1894–96), one copy of which is in the National Museum in Stockholm, and a bronze statue (1903) of the Swedish king Gustavus I (q.v.) in Mora.

ZOROASTER, or ZARATHUSHTRA (about 630–541 B.C.), religious prophet, founder of Zoroastrianism (q.v.), born in the eastern Persian land of Airyana Vaejah, probably during the period preceding that of the Achaemenian kings, although earlier dates have been suggested; see PERSIA. When still a fairly young man he began receiving revelations from Ahura Mazda ("the Lord Wisdom"). His conversations with this godhead, and his difficulties while preaching, are recorded in the Gathas; see AVESTA. Apparently it was after years of struggle with priests of established cults (during which time he had made some converts among his relatives and others) that he found a champion in the ruler Vishtaspa, who is sometimes identified with Hystaspis (fl. 521 B.C.), the father of Darius I, King of Persia (see under DARIUS). Thereafter the religion preached by Zoroaster prospered. Zoroaster's homeland was mountainous, devoted to the raising of cattle, which were considered sacred animals. Through his religion, he had hoped to unite cattle herders against nomadic marauders and practitioners of certain sacrificial cults. Still, the intellectual depth of his system may well have exerted a profound influence on Western thought; Plato, Aristotle (qq.v.) and other Greek thinkers showed a great interest in his doctrines. It is at least quite likely that Zoroaster's ideas strongly affected the course of Judeo-Christian demonology, angelology, and eschatology (q.v.). They have been traced recently in the *Manual of Discipline* found among the Dead Sea Scrolls (q.v.). See also PERSIAN LANGUAGE AND LITERATURE.

ZOROASTRIANISM, Iranian religion whose name and essence derive from the Persian prophet Zoroaster (q.v.). The doctrines preached by Zoroaster are preserved in his metrical Gathas ("psalms"), which form part of the sacred scripture known as the Avesta (q.v.).

Tenets. The basic tenets of the Gathas consist of a monotheistic worship of Ahura Mazda ("the Wise Lord" or better "the Lord Wisdom"), and an ethical dualism opposing Truth (Asha) and Lie, which permeate the entire universe. All that is good derives from, and is supported by, Ahura Mazda's emanations: Spenta Mainyu ("the Holy Spirit" or "Incremental Spirit", a creative force), and his six assisting entities, Good Mind, Truth, Power, Devotion, Health, and Life. All evil is caused by the "twin" of

Spenta Mainyu, who is Angra Mainyu ("the Fiendish Spirit"; in Persian, Ahriman) and by his assistants. Angra Mainyu is evil by choice, having allied himself with Lie, whereas Spenta Mainyu has chosen Truth. So too, man must choose. Upon death each person's soul will be judged at the Bridge of Discrimination; the follower of Truth will cross and be led to Paradise, and the adherents of Lie will fall into Hell. All evil will eventually be eliminated on earth in an ordeal of fire and molten metal.

The Gathas and the Seven Chapters. The structural complexity of the Gathic scheme has best been explained by the assumption that Zo-



Supposed portrait of Zoroaster (fresco of the 2nd-century A.D.).
Yale University Art Gallery

roaster amalgamated two religious systems. The first is outlined in the Gathas and is most probably Zoroaster's own; this is the monotheistic worship of Wisdom and his emanations (including Asha). The second, describing a cult worshipping a Lord (Ahura) who is custodian of Asha, is actually attested to in a portion of the Avesta, the Liturgy of the Seven Chapters, composed after Zoroaster's death in his own dialect. Zoroaster's teaching is praised and revered in the later section; its religious outlook, however, in part amalgamating earlier beliefs in Iran, is quite different from that of the Gathas. In the

Seven Chapters, the emanations occur in the company of other sacred abstractions; Ahura has the epithet "possessing Asha", but Lie and Angra Mainyu are not mentioned. Many natural objects and mythical creatures, as well as ancestor spirits, are worshiped, and the very figure of Ahura Mazda resembles not so much Zoroaster's deity as the god Varuna (sometimes called the Asura, "Lord") of the most ancient Indian religious compositions, the Rig-Veda; see INDIAN MYTHOLOGY; VEDA.

The ancestors of the Iranians (that is, the Aryan subgroup of the Indo-European peoples) and the invaders of northern India were of the same stock, and it may be assumed that they worshiped a number of similar deities. The Ahura of the Seven Chapters has wives, called Ahuranis, who, like Varuna's Varunanis, are rain clouds and waters. Ahura is possessor of Asha, as Varuna is custodian of Rta ("Truth" or "cosmic order" = Asha = Old Persian Arta). The sun is the "eye" of both deities, and the name of Ahura is at times joined to that of the god Mithra. In the Vedas, the names of Mithra and Varuna are similarly joined. The Seven Chapters also revere Haoma (Vedic, Soma), a divinized plant yielding an intoxicating juice (perhaps the "filth of intoxication" against which Zoroaster warned). The worship of ancestors and nature spirits and other deities (for example, the fire-god, called Agni by the Hindus) likewise have Vedic correspondences; see also HINDUISM.

The Yasna and the Vendidad. The Gathas and the Seven Chapters form part of the larger liturgy called the Yasna, the remainder of which is composed in another, but closely related, dialect. This material further illustrates the incorporation of the Aryan polytheistic paganism into Zoroastrianism, as do the linguistically similar Yashts, which are hymns to individual deities. Among these deities may be mentioned Anahita, a fertility and river goddess probably borrowed (as was, perhaps, the curious custom of incestuous marriages) from the non-Aryan Elamites; see ELAM. The latest part of the Avesta, the Vendidad or Videvdat, was composed after the Greek conquest of Persia in the 4th century B.C., and is in the main a codification of ritual and law, somewhat similar in tone to the Old Testament book of Leviticus (q.v.). It reflects those customs attributed by the Greek historian Herodotus (q.v.) to the Magi (q.v.), a priestly caste of Median origin. These customs include exposure of corpses, protection of dogs, and the gleeful slaughter of crawling animals. The Avesta was composed in eastern Persia, as may be judged from its language and place-names.

Recognition and History. In southwestern Persia, probably the first Persian king to recognize the religion proposed by Zoroaster was Darius I (see under DARIUS). His inscriptions are full of the praises of Ahura Mazda; he stresses rationality, and seems to regard Lie as a world force. His son, Xerxes I (q.v.), was also a worshiper of Ahura Mazda, but he probably had less of an understanding of the details of Zoroaster's religion. Most striking is his conception that Arta will be attained in the afterlife, which view reflects the old Aryan idea that Rta has a location beyond the earth. Artaxerxes I (r. 464–424 B.C.) was also a Mazda worshiper, but probably approved of a synthesis, under Magian direction, of Zoroaster's teachings with the older polytheism; this development is reflected in the syncretism of the Yashts. Artaxerxes II (r. 404–359 B.C.) venerated Ahura Mazda, Mithra, and Anahita; in his reign the first Persian temples were probably built. Under the rule of the Greek Seleucids (312–64 B.C.) and Parthian Arsacids (about 250 B.C.–226 A.D.), cults of foreign gods flourished along with Zoroastrianism. The new Persian dynasty of the Sassanians (226–651 A.D.) established Zoroastrianism as the state religion of Persia. In the Sassanian theology, Ahriman was opposed to Ohrmuzd (Ahura Mazda), not to Spenta Mainyu. This theology had already appeared in the Magian system of the 4th century B.C., according to Greek historians. Certain Sassanian theologians taught that Ohrmuzd and Ahriman were the twin sons of Infinite Time (Zervan), but this doctrine was eventually rejected.

Persia became Muslim with the advent of the Arabs in the 7th century; see ISLAM. Zoroastrianism survived, however, in small communities of "Ghabrs" in the mountainous regions of Yezd and Kerman. About 10,000 still live in Iran. Zoroastrians, called Parsees (q.v.) or "Persians", are numerous and prosperous in India, chiefly in the vicinity of Bombay. They still recite the Avestan liturgy and tend the sacred fires, but nowadays they prepare a nonintoxicant "haoma". In accordance with the Magian doctrine, the Parsees place corpses on raised edifices (the so-called towers of silence) to be the prey of vultures.

Zoroastrianism is somewhat unique among Oriental religions in its eschewal of asceticism (q.v.). Its chief motto is "Good thoughts, good words, good deeds".

See also PERSIA; PERSIAN LANGUAGE AND LITERATURE; RELIGION: *The Religions: Salvation*. M.Sc. ZORRILLA Y MORAL, José (1817–93), Spanish playwright and poet, born in Valladolid, and ed-

uated at the universities of Toledo and Valladolid. A prolific writer, he published forty plays, largely national histories, between 1839 and 1849. He also completed *Cantos del Trovador* ("Songs of the Troubadour", 3 vol., 1840–41), which consists of Spanish legends told in verse form. In 1850 he moved to France and in 1855 to Mexico, where he gained the patronage of Emperor Maximilian (q.v.). Returning to Spain in 1866, he found that, although his plays had become extremely popular, he could not collect royalties. He was impoverished until he was granted a small government pension near the end of his life. In 1889 he was made poet laureate of Spain.

Zorrilla is considered to be one of the truly outstanding figures of the Romantic movement in Spanish literature. His genius as a poet of this era is best exhibited in his legends and in his epic *Granada* (1852). His most important dramatic works include *Don Juan Tenorio* (1844; Eng. trans., 1944), which remains the most popular of all Hispanic plays, and *Traidor, Incofeso y Mártir* ("Traitor, Sinner, and Martyr", 1849). Zorrilla's autobiography, *Recuerdos del Tiempo Viejo* ("Recollections of Times Past") appeared in 1880. See also SPANISH LITERATURE: *From 1700 to the Present: Romanticism*.

ZOSIMUS, Saint (about 350–418), pope in 417–18, born in Greece. Almost nothing is known of his early life. He was consecrated pope on March 18, 417, following the death of Pope Innocent I (see under INNOCENT). He aroused opposition from the other bishops of Gaul by naming the bishop of Arles as papal vicar. Zosimus also created a conflict with the African bishops when he asked them to reconsider their censure of Pelagianism (q.v.); ultimately, however, he approved their condemnation of that doctrine. His traditional feast day is Dec. 26.

ZRENJANIN, city of Yugoslavia, in the constituent republic of Serbia, on the canalized Begej R., 26 miles N.E. of Novi Sad. Industries include vegetable canning, sugar refining, flour milling, brewing, and the manufacture of agricultural equipment, molasses, dried beet pulp, and dairy products; carpets are made in the surrounding area. Lying in the often disputed Banat (q.v.) region, the city was known as Nagybecskerek when it was part of Hungary before 1919. It was called Veliki Bečkerak until the 1930's and Petrovgrad until the late 1940's. Pop. (1971) 59,580.

ZSIGMONDY, Richard (1865–1929), German chemist, born in Vienna, Austria, and educated at the University of Munich. From 1897 to 1900 he worked as a research chemist at the glass-

works in Jena, and for the following seven years was engaged in private research. After 1907 he was professor of inorganic chemistry at the University of Göttingen. An authority on colloid chemistry, Zsigmondy made outstanding contributions in that field; see COLLOIDAL DISPERSION. With the German physicist Henry Friedrich Wilhelm Siedentopf (1872–1940), he invented the ultramicroscope, an optical instrument which makes it possible to see, as flashes of scattered light, particles too tiny to be rendered visible in the common microscope. For his demonstration of the heterogeneous nature of colloid solutions Zsigmondy was awarded the 1925 Nobel Prize in chemistry. His writings include *Colloids and the Ultramicroscope* (1905; Eng. trans., 1909).

ZUCCHINI (fr. It. *zucchini*, "small squash"), common name applied to a variety of summer squash (q.v.), the fruit of a dwarf bush belonging to the genus *Cucurbita*. The plant has short stems and upright, deeply lobed leaves. The fruit is small, oblong, and green, and is harvested while still immature. Used as a vegetable, zucchini is rich in vitamin A and also provides considerable amounts of riboflavin, iron, and calcium; see NUTRITION, HUMAN; VITAMIN. Cooking preparation generally includes boiling or sautéing unpeeled, sliced sections of the fruit.

ZUGSPITZE, mountain of s. West Germany, part of the Wettersteingebirge range of the Bavarian Alps. Situated at the border of Austria, it is 9718 ft. high and is the highest mountain in Germany. At the base of its N. face is Garmisch-Partenkirchen, a popular winter resort, from which a railroad leads to the summit. The W. face is connected by an aerial tramway to Ehrwald, Austria. See also ALPS: *Eastern Alps*.

ZUIDER ZEE. See IJSSSELMEER.

ZULOAGA, Ignacio (1870–1945), Spanish painter, born in Éibar, and trained in Rome and Paris. When he was only twenty years old his paintings were exhibited at the Paris Salon. He continued to study and work in Paris until 1900; and subsequently settled in the Spanish province of Segovia. In both Paris and Spain he painted subjects of his native Basque country, depicting with remarkable fidelity gypsies, bullfighters, beggars, fruit vendors, water carriers, and dancers. His genre compositions achieved a considerable vogue, and he also painted members of fashionable society.

One of the most influential Spanish artists of his generation, Zuloaga consciously executed his paintings in the tradition of the old Spanish masters. Like them, he achieved vivid realistic effects by painting glowing foreground colors against subdued background hues. He was in-

fluenced particularly by the Spanish painters El Greco, Diego Rodríguez de Silva y Velázquez, and Francisco José de Goya y Lucientes (qq.v.). Representative works by Zuloaga are owned by many of the major museums of Europe and of the United States, including "Gypsy Bull Fighter's Family" (1903), which is in the museum of the Hispanic Society in New York City. *See also* SPANISH ART: *Painting*.

ZULU, African tribal people of Bantu (q.v.) stock, numbering some 2,200,000 and living mainly in Natal Province, Republic of South Africa. They are a tall, muscular, powerful, and active people whose economy is based on cultivating millet and raising cattle. They also make millet beer, tan hides, smelt iron, and weave baskets. Zulu live in beehive-shaped huts that are grouped together in a circular compound, or kraal, with the cattle in the center. In the 20th century many Zulu left the kraals to find work in the cities and in nearby mines. *See* AFRICAN LANGUAGES: *The Niger-Kordofanian Family*; ZULULAND.

ZULULAND, region of South Africa, in the province of Natal on the Indian Ocean, comprising the N.E. portion of the province. It is the traditional homeland of the Zulu (q.v.), an African people. Cattle herding and the raising of corn, wheat, and other crops are the main occupations. Eshowe is the chief town and administrative center. Area, 10,427 sq.mi.

During the first quarter of the 19th century the Zulu, a small clan living in the valley of the Umfolozi R. and ruled by the warlike chieftain Chaka (1773–1828), dominated southern Africa almost from the Zambezi R. to Cape Colony. Chaka was succeeded in 1828 by his half brother Dingaan (fl. 1838), who was assassinated for political reasons. He in turn was succeeded by Umpanda (d. 1872), who reigned for more than thirty years. His son and successor Cetywayo (d. 1884), who reigned from 1873 until 1878, was the paramount chief not only over the region comprising present-day Zululand, but over a large portion of the Transvaal as well. Border disputes, which had marked relations between the Zulu and the Boers, continued after the British annexed (1877) the Transvaal. On Dec. 11, 1878, the British, seeking to protect their interests, presented Cetywayo with demands amounting to an ultimatum. The Zulu chieftain ignored the demands, and war followed. A British force totaling more than 1200 men was almost annihilated at Isandhlwana on Jan. 22, 1879, but on July 4, 1879, the British won a decisive battle at Ulundi. The Zulu admitted defeat and gave up the struggle. In 1884 Cetywayo was succeeded

by his son Dinizulu. Having gained the throne with the help of Boer Transvaalers, he granted them a strip of land; there they established the so-called New Republic, which was recognized (1886) by Great Britain and incorporated (1888) into the South African Republic (Transvaal). Meanwhile, in 1887, the remainder of Zululand had been annexed by the British. All of Zululand became part of the colony of Natal in 1897. The Zulu were restive under British crown rule, and the imposition (1905) of a poll tax (q.v.) precipitated a revolt. This uprising was crushed the following year.

ZUÑI, tribe of North American Indians who live in a pueblo of the Zuñi Indian Reservation near Zuni (q.v.), N.Mex. The Zuñi constitute a distinct linguistic family. In physical appearance, culture, and social organization they closely resemble other town-dwelling Indians such as the Hopi (q.v.). Like them, the Zuñi are industrious and are noted for weaving, basketry, and pottery making. In addition, they are known for their turquoise jewelry. They farm the arid soil of the region by means of irrigation techniques learned from their forefathers.

The Zuñi have a strong attachment to ancient religious rituals, which are tied closely to the changing seasons and include special devotion to the rain god. A tightly organized priestly caste exercises great power over the tribe.

Present-day Zuñi are descended from the inhabitants of the seven Zuñi towns discovered in 1539 by the Franciscan missionary Marcos de Niza (d. 1558) and called by the Spanish the Seven Cities of Cibola. Although he had only seen one of the villages from a distance, de Niza reported that the Zuñi possessed fabulous riches, and in 1540 the Spanish explorer Francisco Vásquez de Coronado (q.v.) led an expedition against the Seven Cities. He conquered the Zuñi but found no treasure. Although a Christian mission was established among them in 1629, the Zuñi clung to their old beliefs. In 1680, when they numbered about 2500, the Zuñi joined the successful Pueblo Indian uprising against the Spanish, who subjugated them again in 1692. As a result of various smallpox epidemics, the Zuñi population declined to about 1640 in 1910 but by the late 1960's, it had increased to about 3600. *See also* PUEBLO INDIANS.

ZUNI, Pueblo Indian village and unincorporated community of New Mexico, in McKinley Co., on the Zuni R., in the Zuni Indian Reservation, about 35 miles s. of Gallup. The chief occupations are farming and the production of such handicrafts as silver and turquoise jewelry. The village was built about 1695 on the site of one of

the Zuni towns that flourished early in the 16th century and which were referred to by the Spanish explorers as the Seven Cities of Cibola. Pop. (1960) 3585; (1970) 3958.

ZUNZ, Leopold (1794–1886), German scholar, born in Detmold, and educated at the University of Berlin.

While still a student, he published *Etwas über die Rabbinische Literatur* ("Something about Rabbinical Literature", 1818); the booklet was the first objective appraisal of rabbinical writings as products of Jewish life. Zunz helped establish the Society for the Culture and Science of the Jews, an educational organization. His most influential work, *Die Gottesdienstlichen Vorträge der Juden* ("The Religious Discourses of the Jews", 1832), describes the intellectual achievements of Judaism from Biblical times to his own day, as reflected in the synagogue sermons of each period. Zunz settled permanently in Berlin in 1840 and became a leader in Jewish education. In his later years he made pioneering studies of the Hebrew liturgy. He is regarded as the originator of the systematic and critical study of the Jewish religion as a social phenomenon.

ZURBARÁN, Francisco de (1598–1664), Spanish painter, born in Fuente de Cantos, Badajoz Province. He was apprenticed to a minor Spanish painter in Seville at the age of sixteen, but appears to have been influenced early in his career by the Italian painter Michelangelo da Caravaggio (q.v.). In 1617 he went to work in Llerena and in 1629 the town council of Seville, taking note of his growing fame, invited him to paint and live in the Andalusian capital; Zurbarán spent the next thirty years there, with the exception of two years (1634–35) which he spent in Madrid working on a number of paintings at the royal court for Philip IV (q.v.), King of Spain. Zurbarán left Seville in 1658, after his reputation declined there; he died in Madrid.

In mid-career Zurbarán became acquainted with the works of the Spanish painters Diego Rodríguez Velázquez and José Ribera (qq.v.), but was only slightly influenced by them. Late in his career, however, he changed his style, according to some critics, for the worse, after being influenced by the Spanish painter Bartolomé Esteban Murillo (q.v.), whose popularity had eclipsed his own.

Zurbarán's earliest known work, painted when he was eighteen, is an "Immaculate Conception" (private collection, Bilbao). Other notable early works include a "Crucifixion" (1627–29; Museum of Fine Arts, Seville), several large

scenes of the life of Saint Peter Nolasco (d. 1256), the founder of the Mercedarians, originally done for a convent in Seville (1628–29; since dispersed to various museums), "The Apotheosis of Saint Thomas Aquinas" (1631; Museum of Fine Arts, Seville), and "Still Life with Oranges" (1633; Contini-Bonacozzi Collection, Florence). The "Saint Thomas" is considered his masterpiece and one of the great works of Spanish art.

Zurbarán devoted himself to religious subjects, portrayals of saints and portraits of the clergymen of his day, the humble monks and friars as well as the great church dignitaries. His use of sharply defined, often brilliant, colors, minute detail in simple compositions, strongly three-dimensional modeling of figures, and the shadowed light which brightly illuminates his subjects, give his paintings a solidity and dignity

"Doctor of Law at the University of Salamanca" by Francisco de Zurbarán.
Isabella Stewart Gardner Museum





Evening view of Limmat Quay in Zürich, Switzerland. At left is a guildhall of the early 17th century. The twin towers of the old Grossmünster can be seen in the background.

V. Lefteroff-Photo Researchers

highly evocative of the solitude and solemnity of monastic life. His work at its best fuses two dominant tendencies in Spanish art, realism and mysticism (qq.v.).

See also SPANISH ART: Painting.

ZÜRICH, city in Switzerland, and capital of Zürich Canton, on the Limmat R. and at the N. end of the Lake of Zürich, about 60 miles N.E. of Bern. Zürich is the largest city in the country and the leading commercial, insurance, and industrial city of Switzerland. It is also one of the main financial centers of Europe. Among the chief industries of Zürich are printing, publishing, and the production of electrical equipment, processed foods, machinery, textiles, and tools. Although a modern metropolis, Zürich has retained much of its historic charm. It is the site of numerous architectural landmarks, including the Protestant church the Grossmünster, built chiefly in the 11th and 13th centuries, where Huldreich Zwingli (q.v.), a leader of the Reformation, preached; the Fraumünster, dating from the 13th century; and the 17th-century Town Hall. An educational center, the city is the site of Zürich University, founded in 1833; the Swiss Federal Institute of Technology, founded

in 1855; and several museums of art and history. The poet and novelist Gottfried Keller and the educational reformer Johann Heinrich Pestalozzi (qq.v.) were born here.

History. Remains of prehistoric lake dwellings (q.v.) have been found on the site of present-day Zürich. The Helvetii (q.v.) were among the Celtic tribes that settled the area. The Romans captured the community in 58 B.C. and named it Turicum. It later came under the successive control of the Alamanni, Franks, and Swabians. Zürich became eventually an ecclesiastical center. In 1218 it was designated a free imperial city of the Holy Roman Empire. In 1351 it joined the Swiss Confederation. The Swiss Reformation was initiated in Zürich in 1519 under the leadership of Zwingli. Pop. (1972 est.) 416,100.

ZÜRICH, LAKE OF, lake of Switzerland, in the N.E. part of the country, chiefly in Zürich Canton. The lake is crescent shaped and has a length of 25 mi., a maximum width of 2½ mi., and a total area of 34 sq.mi. Its maximum depth is about

ZWEIG

470 ft. and its height above sea level is some 1340 ft. The Linth R. flows into the lake at its s.e. end; the Limmat R., at the n.e. end, is its outlet. Zürich (q.v.) is the principal city on its shores. **ZWEIG, Arnold** (1887–1968), German novelist, playwright, and essayist, born in Glogau (now Głogów, Poland), and educated at various German universities including those at Breslau, Berlin, and Göttingen. His first major work was *Novellen um Claudia* (1912; Eng. trans., *Claudia*, 1930), a cycle of interconnected short stories.



Arnold Zweig

UPI

Zweig was a private in the German army in World War I. Out of his wartime experiences came the novel *Der Streit um den Sergeanten Grischa* (1927; Eng. trans., *The Case of Sergeant Grischa*, 1927), considered one of the greatest of all war novels. It is the story of a Russian soldier who, taken prisoner by the Germans, becomes a victim of their bureaucratic military machinery. Some of the characters in the novel reappear in Zweig's later books.

In 1933, when the German dictator Adolph Hitler (q.v.) came to power, all of Zweig's property was confiscated and he fled to Palestine. In 1948 he returned to East Germany. Zweig was president of the East German Academy of Letters from 1950 to 1953 and winner of the Lenin Peace Prize in 1958.

Zweig's work combines a broad humanity with objective realism and a subtle irony. He

wrote extensively about the Jews and Zionism, including the novel *De Vriendt Kehrt Heim* (1932; Eng. trans., *De Vriendt Goes Home*, 1933) and the essay collection *Bilanz der Deutschen Judenheit* (1934; Eng. trans., *Insulted and Exiled*, 1937). Among his later writings are *Die Zeit Ist Reif* ("The Time Is Ripe", 1957), *Essays I* (1959), and *Essays II* (1967).

ZWEIG, Stefan (1881–1942), Austrian writer, born in Vienna, and educated at the University of Vienna. He began to write while still a student, and when he was only nineteen years old his book of poems *Silberne Seiten* ("Silver Pages") was published. The next few years were devoted to extensive travels in Europe and Asia. Following the outbreak of World War I Zweig became an ardent pacifist. In his first major work, the dramatic poem *Jeremias* (1917; Eng. trans., *Jeremiah*, 1922), he passionately denounced what he regarded as the supreme madness of war.

Zweig settled in Salzburg after the war, and wrote numerous biographies, upon which his reputation mainly rests, as well as short stories, novelettes, and essays. Among the works written between 1918 and 1933 are the biographies, including *Drei Meister* (1920; Eng. trans., *Three Masters*, 1930), studies of the French novelist Honoré de Balzac, the British novelist Charles Dickens, and the Russian novelist Fëdor Mikhailovich Dostoevski (qq.v.); and *Die Heilung durch den Geist* (1931; Eng. trans., *Mental Healers*, 1932), accounts of the Austrian psychologists Franz Anton Mesmer and Sigmund Freud and the American religious leader Mary Baker Eddy (qq.v.).

The rise of National Socialism and anti-Semitism (qq.v.) in Germany and Zweig's fears of possible consequences in Austria led to his self-exile to England in 1934. In 1938 he undertook a lecture tour in the United States and returned to the U.S. in 1940, after becoming a British citizen, to live for a while in Ossining, N.Y. He migrated to Brazil in 1941, where he committed suicide the following year because of his feeling of homelessness, loneliness, and spiritual fatigue.

As a writer, Zweig is distinguished for his psychological insight. By omitting unessential detail, he was able to make his biographies as readable as novels. Zweig's later important writings include the biographies *Triumph und Tragik des Erasmus von Rotterdam* (1934; Eng. trans., *Erasmus of Rotterdam*, 1934), and *Maria Stuart* (1935; Eng. trans., *Mary, Queen of Scotland and the Isles*, 1935); the novel *Schachnovelle* (posthumously published, 1944; Eng. trans., *The Royal Game*, 1944), and his autobiography,

Die Welt von Gestern (1941; Eng. trans., *The World of Yesterday*, 1942).

ZWICKAU, city of East Germany, in Karl-Marx-Stadt District, on the Mulde R., about 40 miles s. of Leipzig. The city is an industrial center and is located within a coal-mining region. Local manufactures include chemicals, electrical equipment, mining machinery, porcelain, and textiles. Places of interest include the 15th-century Church of Saint Mary, which ranks among the finest examples of German Gothic architecture, and the 16th-century town hall. The city is the birthplace of the German composer Robert Schumann (q.v.).

Founded as a Slavic settlement in the 11th century, Zwickau began to flourish as a trading center in the 12th century, and in 1220 it was made a city. Zwickau was a free imperial city from 1290 to 1323, when it became subject to the principality of Meissen. From 1520 to 1525 the city was one of the chief strongholds of the Anabaptists (q.v.). Zwickau became an industrial city in the 19th century. Pop. (1972) 124,796. **ZWINGLI, Huldreich** or **ZWINGLI, Ulrich** (1484–1531), Christian theologian, leader of the Reformation in Switzerland (see REFORMATION: National Movements: Switzerland), born in Wildhaus, Sankt Gallen. He was educated at the universities of Vienna and Basel.

Early Influences. During his formative years Zwingli was deeply influenced by the spirit of liberal humanism (q.v.). In 1506 he was ordained and assigned to the town of Glarus as a parish priest. Glarus then was well known as a center for the recruiting of mercenary soldiers for Europe's armies. On two occasions Zwingli served as chaplain with Glarus troops during bloody fighting on foreign soil, and these experiences led him to denounce the mercenary system publicly. In retaliation certain town officials conspired to make his position at Glarus untenable. In 1516 he accepted an appointment at Einsiedeln, 20 miles s.e. of Zürich.

During his ministry at Einsiedeln, Zwingli began to entertain doubts about certain church practices. In 1516 he read a Latin translation of the Greek New Testament published by the Dutch humanist Desiderius Erasmus (q.v.), which he later transcribed into notebooks and memorized verbatim. On the basis of these and other scriptural readings Zwingli charged in sermons that church teachings and practice had diverged widely from the simple Christianity of the Holy Writ. Among the practices cited by Zwingli as unscriptural were the adoration of saints and relics, promises of miraculous cures, and church abuses of the indulgence system;

see INDULGENCE; MIRACLE; RELICS; SAINT. His forthright affirmations of scriptural authority won him wide popular repute, and on Jan. 1, 1519, he was appointed priest at the Gross Münster (Ger., "Great Cathedral") in Zürich.

Adoption of the Reformation. Zürich was a center of humanist belief, with a tradition of state limitation on the temporal power of the church. Zwingli quickly attracted large audiences to the cathedral by expounding the original Greek and Hebrew Scriptures chapter by chapter and book by book, beginning with the Gospel of Matthew; see BIBLE, INTERPRETATIONS OF THE. These oral translations of the original Scriptures broke sharply with church tradition. Hitherto priests had based their sermons on interpretations of the Vulgate (q.v.) and on the writings of the Fathers of the Church (q.v.). In 1519 an admirer placed a printing press at the reformer's disposal and his bold new ideas spread far beyond the confines of Zürich.

During the same year Zwingli read for the first time the writings of his contemporary, the German Reformation leader Martin Luther (q.v.). Heartened by Luther's stand against the German hierarchy, Zwingli in 1520 persuaded the Zürich council to forbid all religious teachings without foundation in the Scriptures. Among these teachings was the church stricture against eating meat during Lent (q.v.). In 1522 a group of his followers deliberately broke the rule and were arrested. Zwingli vigorously defended the lawbreakers, who were released with token punishment.

Pope Adrian VI (see under ADRIAN), angered by Zwingli's behavior, then forbade him the pulpit and asked the Zürich council to repudiate him as a heretic. In January, 1523, Zwingli appeared before the council to defend himself. He asserted the supremacy of the Holy Writ over church dogma (q.v.), attacked the worship of images, relics, and saints, and denounced the sacramental view of the Lord's Supper (q.v.) and enforced clerical celibacy (q.v.) as well. After deliberation the council upheld Zwingli by withdrawing the Zürich canton from the jurisdiction of the bishop of Constance; it also affirmed its previous ban against preachings not founded on the Scriptures. By taking these steps the council officially adopted the Reformation. Zwingli in 1524 marked his new status by marrying Anna Reinhard, a widow with whom he had lived openly.

Under the Reformation, Zürich became a theocracy (q.v.) ruled by Zwingli and a Christian magistrate. Sweeping reforms were instituted, among them the conversion of monasteries into

hospitals, the removal of religious images and idols, and the elimination of Mass and confession (qq.v.). Eventually Zwingli taught that devout Christians have need of neither pope nor church.

Conflicts among Protestants. During 1525 a radical Protestant group called the Anabaptists (q.v.) challenged Zwingli's rule. In a disputation, however, held before the council on the following Jan. 2, Zwingli defeated the Anabaptists, whose leaders were then banished from Zürich.

In 1529 friends of Martin Luther and Zwingli, concerned over doctrinal and political differences between the two Protestant leaders, had arranged a meeting between them. At this meeting, held in Marburg, and known since as the Marburg Colloquy, Luther and Zwingli clashed over the question of consubstantiation versus transubstantiation (q.v.), and the conference failed to reconcile the two.

Meanwhile, Zwingli carried his crusade to other Swiss cantons besides the canton of Zürich. In all, six cantons were converted to the Reformation. The remaining five, known as the Forest Cantons, remained staunchly Catholic; see ROMAN CATHOLIC CHURCH. The antagonisms between Catholic and Protestant cantons created a serious split within the Swiss Confederation.

The End of the Swiss Reformation. In 1529 the hostility between the cantons flared into open civil war. On Oct. 10, 1531, Zwingli, acting as chaplain and standard-bearer for the Protestant forces, was wounded at Kappel am Albis and later put to death by the victorious troops of the Forest Cantons. After Zwingli's death the Reformation made no further headway in Switzerland; the country is still half Catholic, half Protestant.

See also CALVINISM; REFORMED CHURCHES; SWITZERLAND: *History*. R.N.

ZWORYKIN, Vladimir Kosma (1889–), American physicist, born in Murom, Russia, and educated at the Petrograd Institute of Technology (now the Leningrad M. I. Kalinin Polytechnic Institute), the Collège de France, and the University of Pittsburgh. He emigrated to the United States in 1919 and became a citizen in 1924. In 1929, after nine years in the radio-tube division of the Westinghouse Corporation, he became director of the Electronic Research Laboratory of the Radio Corporation of America (R.C.A.) at Princeton, N.J. until 1954, when he was named an honorary vice-president and consultant of R.C.A.

Important contributions were made by Zworykin to both the transmission and the reception of television (q.v.). He was largely responsible

for the development during the 1920's and the 1930's of the iconoscope, a camera designed for rapid scanning of light rays that enables television signals to be transmitted, and of the kinescope, a cathode-ray tube that translates received signals into a picture; see CATHODE RAYS. He also directed the group that in 1939 successfully produced a powerful electron microscope; see MICROSCOPE: *Electron Microscope*.

ZYGOTE. See FERTILIZATION; SEED.

ZYMASE, in biochemistry, complex group of enzymes (q.v.) that are important in the process of fermentation (q.v.). Zymase causes glycolysis, breaking down carbohydrates such as glucose (q.v.) and glycogen, and causes alcoholic fermentation of sugar (q.v.); see ALCOHOL; CARBOHYDRATES; STARCH. Zymase consists mainly of protein material, and is found in bacteria (q.v.) and yeasts (see FUNGI), and also in higher plants and animals; see PROTEIN.

Zymase was first isolated from the yeast cell in 1897 by the German chemist Eduard Buchner (q.v.), who succeeded in fermenting sugar with it in the laboratory. The British chemist Sir Arthur Harden (q.v.) divided zymase into dialyzable (capable of being passed through a suitable membrane) and nondialyzable varieties in 1905; see COLLOIDAL DISPERSION; OSMOSIS. When some enzymes are dialyzed, small molecular substances known as coenzymes are removed, rendering the enzyme inactive. Today, however, it is possible to dialyze zymase without removing the cozymase because of the latter's smaller molecular size. See CHEMISTRY: *Major Divisions of Chemistry: Biochemistry*.

ZYMOLOGY, or ZYMURGY, in biochemistry, study of the processes of fermentation (q.v.), which are the chemical changes produced in organic substances by the action of bacteria, enzymes (qq.v.), and yeasts (see FUNGI). Zymology includes the study of enzymes, which are the catalysts composed of polymers of amino acids (q.v.), and zymogens, which are the inactive precursors of enzymes, secreted by living cells. In industrial chemistry, zymology is a branch that performs important research into the commercial production of amyl alcohol, ethyl alcohol, and vitamins (q.v.) by yeasts, butyl and propyl alcohol by bacteria, and is also important in the baking, brewing (q.v.), and winemaking industries; see ALCOHOL; BEER; BREAD; WINE. Zymoscope is an instrument used in zymology to determine the fermenting strength of yeast by measuring the amount of carbon dioxide given off by a specific amount of sugar (q.v.). See CHEMISTRY: *Major Divisions of Chemistry: Biochemistry; Organic Chemistry*.

